

# The MINING CONGRESS JOURNAL

Volume 15

JANUARY, 1929

No. 1

## In This Issue

American Mining Congress Holds Convention  
Why the Clearing House of Mining

Treasury Attitude in Administrating Income Tax  
The Flow of Minerals into World Trade

Hydrometallurgy at Advent of 1929  
A Mining School of Distinction

How Anthracite Is Meeting Competition  
Coal's Relation to Government  
The Case for Coal

Mechanization and Human Progress  
Mechanization and the Mine Operator

National Program for Mechanization of Coal Mines  
Analysis of Possibilities of Mechanized Mining  
Mechanization Report on Big Vein Coal Company

Application of Electrical Equipment to Mine Hoists  
New Electrolytical Zinc Plant of Sullivan Mining Company

Outlook for Mining Legislation  
Hearings on Coal Legislation  
Legislative Review

### Contributors:

*Ellsworth C. Alvord, J. G. Bradley, J. W. Furness, Noel Hubbard,  
Stuart Croasdale, B. Mifflin Hood, Albert B. Jessup, J. D. Francis,  
H. E. Willard, Col. M. C. Rorty, J. B. Pauley, Dr. L. E. Young, Charles  
Gottschalk, J. E. Borland, Raymond M. Miller, Hon. Tasker L. Oddie,  
G. B. Southward.*

## HOW TO THROW A BOOMERANG

¶ Pick out as many ambitious men as you can find in your organization—the young men with possibilities—the ones who are pushing their work intelligently, or those who, when a broader outlook is presented to them, can be brought to take a greater interest. ¶ The rest is to send each of their names to us with a subscription to The Mining Congress Journal. The returns to you will pile up, we believe, in a closer knit loyalty on their part, a broader view of all, and particularly your own mining conditions, greater efficiency and new operating ideas. It will put new thoughts in their heads for the new year. We believe you will agree that this magazine is capable of bringing such returns from this small token of your interest in these men.

THE  
MINING CONGRESS  
JOURNAL

841 MUNSEY BUILDING, WASHINGTON, D. C.



Twenty-five years devoted to serving the Mining Industry marks our silver anniversary on the book of time. We are proud of our record and of the host of friends the years have brought.

**ROBERTS AND SCHAEFER CO.**  
ENGINEERS and CONTRACTORS  
PITTSBURGH, PA., 418 OLIVER BLDG. WRIGLEY BUILDING, CHICAGO. HUNTINGTON, W. VA., 514 NINTH AVE.

The equipments we offer today of proved principle and design, and especially developed for predetermined services merit the full consideration of every coal mine operator contemplating the building of new tipples or cleaning plants. These equipments include -- Arms Vibrating Screens -- Rotary Car-Dumpers and Accessory Units -- Arms Air Concentrating Tables -- Menzies Hydro Separators -- Marcus Horizontal Picking Table Screens -- Apron and Shaker Type Loading Booms -- and other cleaning, handling and preparing equipment. Roberts and Schaefer Company, Chicago.

# The MINING CONGRESS JOURNAL

VOLUME 15

JANUARY, 1929

No. 1

## Contents

### EDITORIALS

Revenue Changes Bring Results.....	1	Keeping Ahead of Costs.....	4
Why Associations?.....	2	What Is the Remedy.....	4
Business Self-Government.....	2	Anthracite.....	4
The Closing Session.....	2	Thirty-three to One.....	4
The Special Session.....	2	Facts and Safety.....	5
The Tariff Commission.....	3	Will Hoover Administration Intervene.....	
The Tariff Hearings.....	3	In Business?.....	5
Creating Standards.....	3	The Ownership of Industry.....	5
An Exhausted Subject.....	4		

### FEATURE ARTICLES

	Page
The Treasury Attitude in the Administration of the Income Tax—By Ellsworth C. Alvord.....	9
American Mining Congress Holds Highly Successful Convention.....	11
Why the Clearing House of Mining—By J. G. Bradley.....	16
The Flow of Minerals Into World Trade—By J. W. Furness.....	19
A Mining School of Distinction—By Noel Hubbard.....	23
Hydrometallurgy at the Advent of 1929—By Stuart Croasdale.....	28
The Future of Non-Metallics—By B. Mifflin Hood.....	32
How Anthracite Is Meeting Competition—By Albert B. Jessup.....	34
Coal's Relation to Government—By J. D. Francis.....	41
The Case for Coal—By H. E. Willard.....	46
Mechanization and Human Progress—By Col. M. C. Rorty.....	48
What Mechanization Means to the Mine Operator—By J. B. Fauley.....	52
National Program for Mechanization of Coal Mines—By Dr. L. E. Young.....	53
An Analysis of the Possibilities of Mechanized Mining—By Charles Gottschalk.....	56
Mechanization Report on the Big Vein Coal Company—By G. B. Southward.....	57
Application of Electrical Equipment to Mine Hoists—By J. E. Borland.....	63
New Electrolytic Zinc Plant of Sullivan Mining Company—By Raymond M. Miller.....	70
The Outlook for Mining Legislation—By Hon. Tasker L. Oddie.....	75
Legislative Review.....	76
Hearings on Coal Legislation.....	79

### DEPARTMENTS

	Page
PRACTICAL OPERATING MEN'S DEPARTMENT, COAL .....	63
PRACTICAL OPERATING MEN'S DEPARTMENT, METALS .....	70
REPORT ON THE MECHANIZATION SURVEY .....	57
LEGISLATIVE REVIEW .....	76
NEWS OF THE MINING FIELD.....	81
WITH THE MANUFACTURERS.....	89

## Practical Operating Men's Department

### COAL

*Application of Electrical Equipment to Mine Hoists*

### METALS

*New Electrolytic Zinc Plant of Sullivan Mining Company*

Published Every Month by The American Mining Congress, Washington, D. C.

*Edited under the supervision of James F. Cullbreath, Secretary of The American Mining Congress*

E. R. COOMBES, *Editor*

GUY N. BJORGE, *Associate Editor*

NEWELL G. ALFORD, *Associate Editor*

ERNEST H. PULLMAN, *Legislative Editor*

F. E. PRIOR, *Art Editor*

J. R. HURLBURT, *Advertising Manager*

J. M. HADLEY, *Production Manager*

#### Field Representatives

C. J. NUTTALL

EDGAR SINNOCK

C. B. BLAUVELT

GORDEN D. LEWIS

Copyright 1928 by The American Mining Congress. Entered as Second Class Mail

Matter January 30, 1915, at the Post Office at Washington, D. C.

YEARLY SUBSCRIPTION, \$3.00; SINGLE COPIES, \$0.30

# Roebling



*A Name Renowned in Wire Rope  
Manufacture*

John A. Roebling's Sons Company  
Trenton, New Jersey

# Some Advantages of Jeffrey- BALL BEARING M

IGHTEEN years ago, Jeffrey built the first mine locomotive ever equipped with anti-friction bearings, replacing the bushed type bearings then commonly in use.

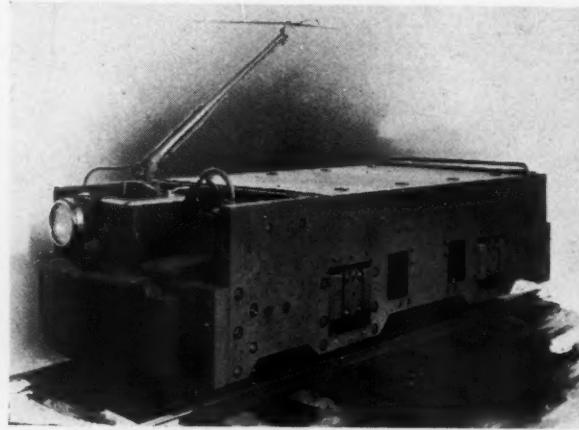
The immediate results obtained are now considered indispensable to good mine locomotive performance.

A uniform air gap and lack of vibration in the brush holders which retain uniform commutation are now taken as matters of fact.

Such common sources of trouble as armatures rubbing on the pole blocks, armature bands breaking, and tearing of armature coils were made outcasts with the introduction of Jeffrey ball bearing motors.

Worn armature shafts and fringed armature cores were other worries of the repair shop that are now forgotten.

Long years of continuous service without appreciable wear have justified beyond any doubt the use of ball bearings on Jeffrey motors.



Today mine men are focusing their attention on the bearing housing because they realize that the life of any bearing is shortened in proportion to the dirt and grit that gets into it.

The labyrinth construction used on Jeffrey locomotive motors serves the double purpose of retaining the lubricant in the bearing housing and preventing any foreign material entering.

Oil throwers between the bearings and armature eliminate oil soaked armatures and fields.

The end thrust of the armature shaft is well taken care of in the application of Jeffrey ball bearings. No adjustment is ever necessary.

All armature shafts in these motors are made of manganese steel and all armature pinions are made of nickel steel. Both properly heat treated to make them hard and tough. Jeffrey Locomotives thus equipped are seldom out of service.

We will appreciate an opportunity to tell you more about their construction.

## The Jeffrey Manufacturing Company

969-99 North Fourth Street, Columbus, Ohio

Branch Offices: New York  
Sales and Service Stations: Birmingham, 26 South 20th St.

Pittsburgh

Scranton, Pa.  
Winchester, Ky., 122 N. Main St.

Philadelphia

Chicago  
Salt Lake City, 153 W. Second South St.

Birmingham

Chicago

Birmingham

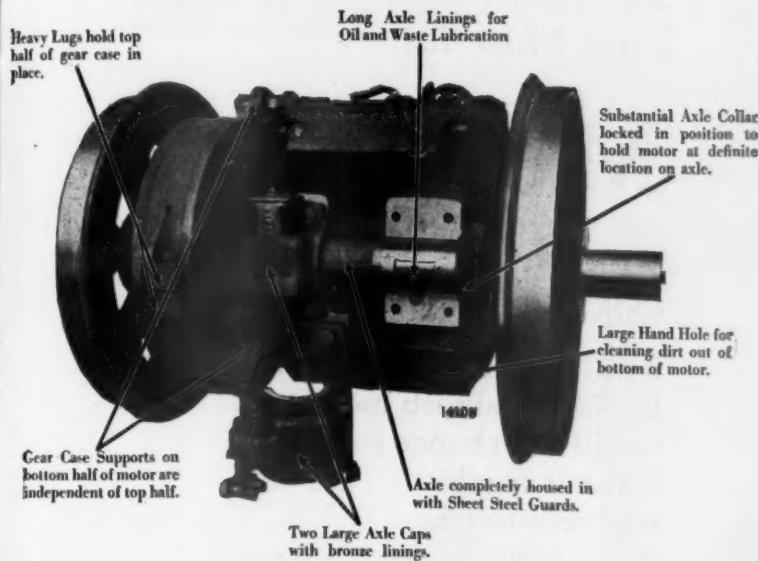
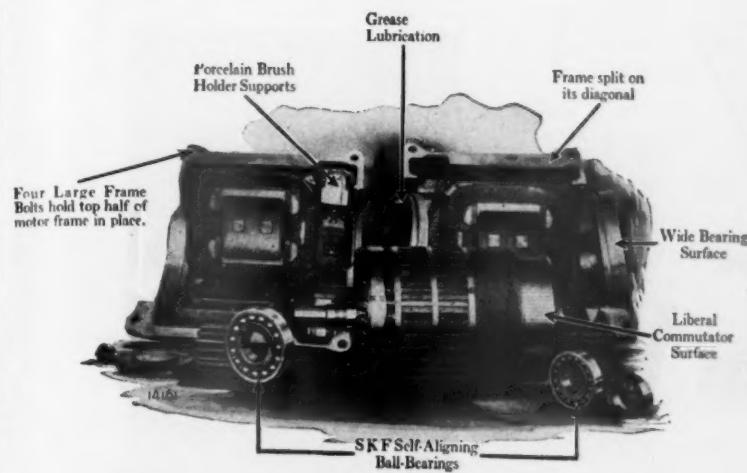
Pittsburgh

Denver

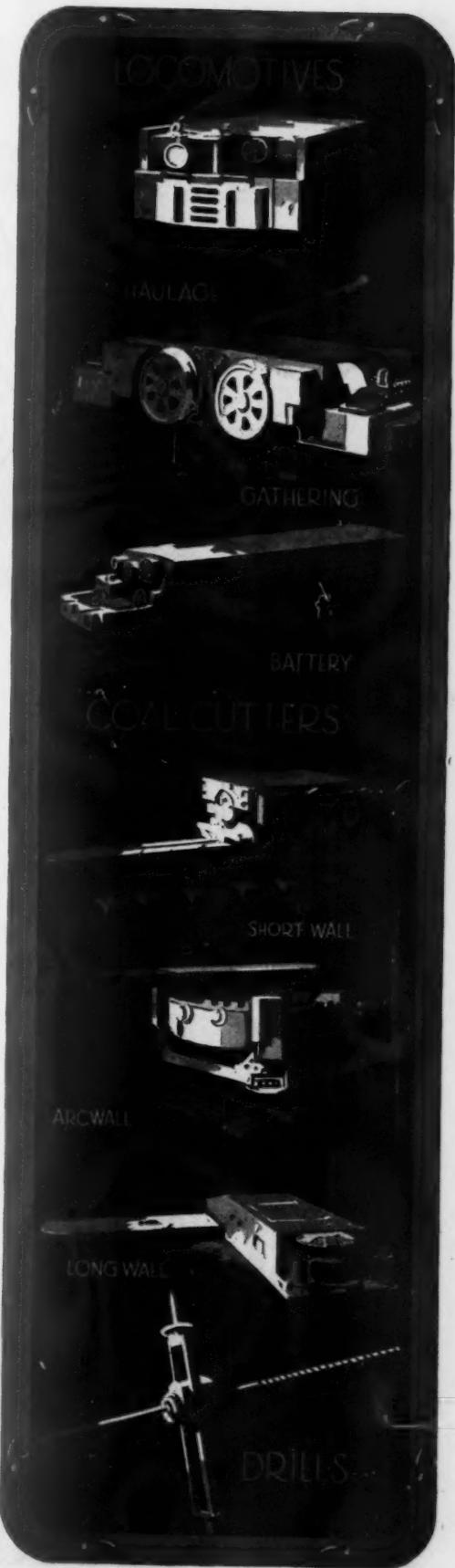
Pittsburgh

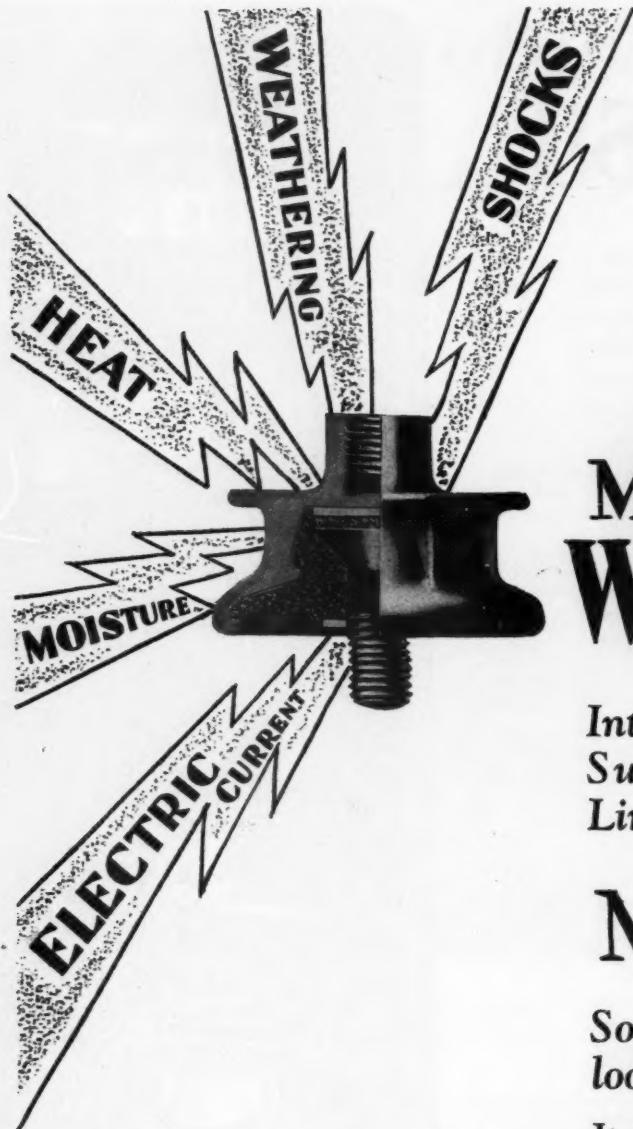
# JEFFREY

# MOTORS



# COAL MINE EQUIPMENT





## This NEW Molded Material Withstands All

Introducing a New Molded Substance to Strengthen Line Material . . .

## Moldarta

Something you have been looking for. •

- It will not soften under intense heat
- It will not absorb moisture
- It will not change color
- It is not fragile
- It is very tough
- It has high dielectric strength

Westinghouse Electric & Manufacturing Co.  
East Pittsburgh

Sales Offices in All Principal Cities of  
the United States and Foreign Countries

T 30276



# Westinghouse Moldarta Suspension

# Speeds up coal preparation!



**I**N coal preparation, the volume of output, the quality of coal, and the profits earned, are directly affected by the screening equipment used.

Screens that speed up production, that are economical of power, and that produce a dependable, uniform grading, assure the maximum profit return.

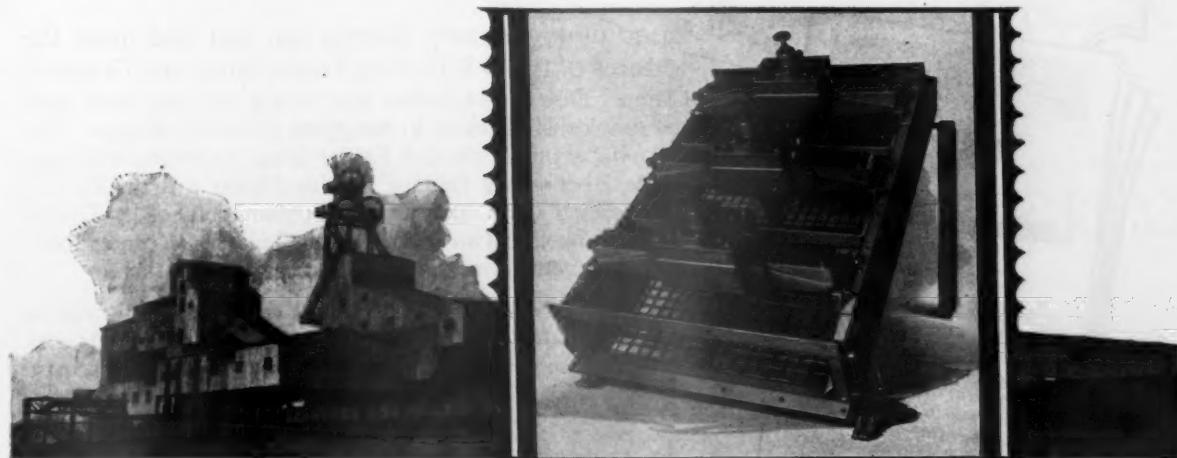
Hum-mer Electric Screens have an earned reputation for thorough separation, continuous operation, and high tonnage.

Ten, twelve, or twenty-four hours per day, week in and week out, the Hum-mer can be depended upon to prepare a high quality of coal and to keep down costs.

Coal for any purpose can be screened more profitably with Hum-mers than with any other type of screen.

Send for the book, "Screening for Profit."

**THE W. S. TYLER COMPANY, *Cleveland, Ohio***  
*Manufacturers of Woven Wire Screens and Screening Equipment*



## **HUM-MER Electric SCREEN**



Here's the Way to Do It?

Suspend the O-B Bulldog Feeder Clamps directly from the mine hangers. This will carry your feeder line. Now "pull in" your trolley wire and suspend the trolley directly from the feeder with O-B Combination Feeder-Trolley Wire Clamps.



O-B Bulldog Feeder Sling

One large curved jaw and a smaller jaw clamp the feeder wire when the head-nut is tightened. The large jaw acts as a sling while feeder is being strung. Made of O-B Flecto iron, hot-dip galvanized. Described on page 505, O-B Catalog No. 20.



Combination Feeder-Trolley Wire Clamp

A combination clamp for spacing and supporting trolley wire and feeder when feeder is strung directly over trolley. Listed in two sizes. Made of O-B Flecto iron, hot-dip galvanized. Described on page 504, O-B Catalog No. 20.



Crystal Gazing

FROM 2 to 4,000 diameters is the range of delicate mechanisms used to magnify and graphically portray the structure of the tiny grains of metal used in the brass and malleable iron which come from O-B foundries. The use of this photomicrographic apparatus is one of the many precautions taken to be sure that only flawless metal is found in O-B products.

## Make the Bill Less with this Give and Take

WITH each passage of the current collector, a gentle but slight up and down movement, with never a hard spot, with no arcing or burning of wire or collector; in short there is a smooth give and take in the overhead construction which practically approaches the ideal when it is catenary construction. The trolley wire lasts much longer. Longer life is had from trolley wheels and bushings. And the suspension fittings themselves suffer less wear. Thus does the "give and take" of catenary construction lessen the bill of maintenance.

In no other catenary fittings can you find quite the features of the O-B Bulldog Feeder Sling, and Catenary Clamp. Ease of installation and lasting qualities have been the first considerations in designing these O-B fittings. The clamping action of the O-B Feeder Sling is identical with that of the labor-saving Bulldog Trolley Clamp with which you are or should be so familiar. The Combination Feeder-Trolley Wire Clamp is a two piece casting held by a center bolt. This arrangement means quick and easy installation.

Yet, despite these many features, the cost of these fittings is not high. You will be pleased to learn how little they do cost in comparison with what they save in trolley replacement costs.

Ohio Brass Company, Mansfield, Ohio  
Canadian Ohio Brass Co., Limited  
Niagara Falls, Canada  
988 MA

Ohio Brass Co. 

NEW YORK CHICAGO PITTSBURGH ATLANTA CLEVELAND  
PHILADELPHIA SAN FRANCISCO LOS ANGELES

PORCELAIN INSULATORS  
LINE MATERIALS  
RAIL BONDS  
CAR EQUIPMENT  
MINING MATERIALS  
VALVES

## DEALER PROFITS LIE IN PERMANENT CONSUMER PATRONAGE

# How the Old Company aids its dealers, day by day:



*The Best Since 1820*



## SUNDAY

The Consumer Family hears the Old Company's Song Recital, with Reinald Werrenrath, on the radio.



## MONDAY

They attend a moving-picture theatre and see the Old Company's film, "The Wonders of Anthracite."



## TUESDAY

They receive in the mail, from their dealer, one of the Old Company's Lehigh mailing pieces.



## WEDNESDAY

They read in their local newspaper an advertisement of Old Company's Lehigh, run by the Company.



## THURSDAY

They find, in the same local newspaper, an advertisement on Old Company's Lehigh, run by their dealer.



## FRIDAY

They see in their dealer's window a display on Old Company's Lehigh, furnished by the Company.



## SATURDAY

They are reminded by seeing the "bull's-eye" signs on several coal trucks to order Old Company's Lehigh of their dealer.

**THE LEHIGH COAL  
AND NAVIGATION COMPANY**  
1421 Chestnut Street  
Philadelphia, Pa.  
NEW YORK BOSTON BUFFALO  
SPRINGFIELD, MASS.

**1820 - OVER A CENTURY OF CONSISTENT SERVICE - 1929**

# Steady Production on Hyattized Mine Cars



The Hyatt Roller Bearing used in mine cars is pictured above. The rollers are hollow cylinders formed by helically winding strips of alloy steel. The rollers are heat-treated—developing hardness and maximum toughness—then accurately ground to size.

The rollers are wound right and left hand and assembled alternately. This construction continuously sweeps the lubricant across all the bearing surfaces.

The rollers, spacing bars and end rings are assembled to make a complete, self-contained unit. The rollers operate directly on the axle and within a split outer race or sleeve which is furnished with the assembly.

**M**INE CARS that deliver an efficient day's work build sound haulage systems—the foundation of all profitable mining.

Do your mine cars loaf on the repair track—guzzle barrel after barrel of grease—or waste most of your power? Look to the bearings.

Putting Hyatts in your running gear not only cancels these troubles—but places "haulage" in large figures on the right side of your ledger. For cars are free-running, production is swift . . . when frictionless Hyatts are employed.

Strong steel rollers withstand hard use and keep oil circulating . . . eliminating wear, breakdowns, delays. Labor and maintenance attention is reduced to infrequent lubrications.

Profit saving in every respect, Hyatts assure more efficient, more economical operation of your equipment.

Why not keep your production moving steadily . . . with Hyattized equipment. Most prominent manufacturers furnish Hyatt equipped cars, when specified.

**HYATT ROLLER BEARING COMPANY**  
NEWARK DETROIT CHICAGO PITTSBURGH OAKLAND

**H Y A T T**  
**ROLLER BEARINGS**  
[ PRODUCT OF GENERAL MOTORS ]



The Joy Company manufactures the patented underground coal loader which is now being used by more than fifty operating mining companies in ten coal producing states. These machines have guaranteed loading capacities of two tons per minute.

Joy machines produced over half of all mechanically loaded bituminous coal in the United States in 1927.

In addition to underground loaders this company also manufactures a snow loading machine for city street cleaning and snow removal on arterial highways.

The snow loaders carry the same patented gathering head device used on the underground machines, and operate at capacities ranging from ten to twenty cubic yards of snow and ice per minute.

**JOY**  
**Manufacturing Company**  
**FRANKLIN, PENNA.**

Twice  
or  
1/2

CONVEYOR SALES CO., INC.  
299 Broadway, New York

**TWICE the TONNAGE  
or ONE-HALF the  
COST per Man**

Tonnage UP or Cost DOWN—which appeals the more to you? You can take your choice with the COSCO Shaker Conveyor System installed in your mines.

More than 300 successful plants operating in American mines are proving the COSCO Conveyor to be a money maker under conditions impossible for any other system.

Built from American materials, to American standards, with exclusive patented features particularly adaptable to American mining methods.

Whether YOUR problem is one of OVER or UNDER production, high or low tonnage cost, inefficient man-power, or what not—let us show you the solution with the COSCO A-20 or B-15 Drives and Troughing, equipped with improved flanged rollers and "Duckbill."



COSCO  
B-15 DRIVE  
The perfected  
low-seam drive

**COSCO**

**Shaker  
CONVEYOR**

**"Convey Your Coal the Cosco Way"**

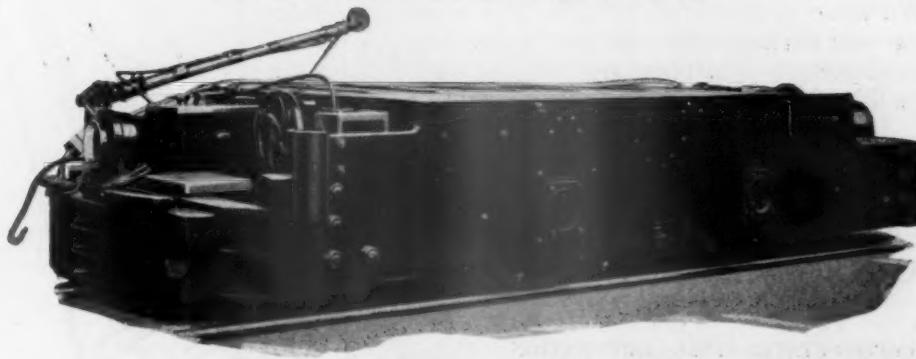
# ON ALL SIDES—



**Goodman**



**Locomotives**



**Show the Way!**

(93)

Three views of a Goodman 8-ton, Slow Speed Gatherer, equipped with an electric reel, 500 ft. rubber-covered cable; transverse equalizer; alloy steel grids, roller bearing axle boxes, shouldered frame construction. Deck Height 30 in.

BUILDERS OF MINE LOCOMOTIVES FOR 38 YEARS

**GOODMAN**  
Locomotives - Loaders - Coal Cutters

MANUFACTURING  
COMPANY  
HALSTED ST. at 48<sup>th</sup>  
CHICAGO --- ILL.  
PITTSBURGH - HUNTINGTON, W. VA - CINCINNATI - BIRMINGHAM - ST. LOUIS - DENVER - PRICE, UTAH

# Copper Steel adds years of service

In coal mines where floors are damp, the life of wood ties is exceedingly short. They soon rot and decay. Very dry floors are also destructive, causing dry rot. Ordinary steel ties last for a longer period under these adverse conditions, but corrosion finally ends their usefulness.

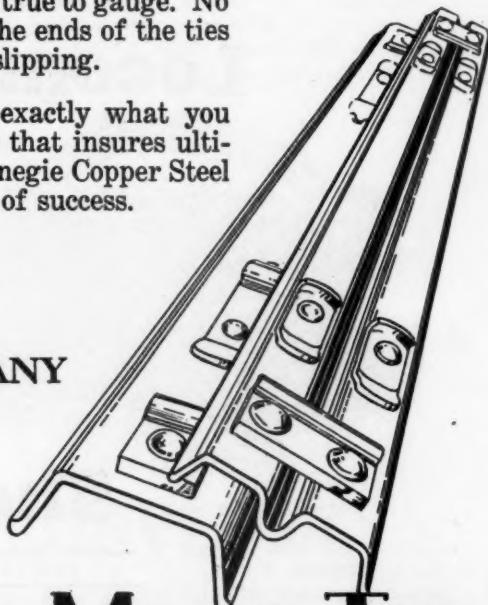
Carnegie Mine Ties are made of Copper Steel. Copper resists rust and when added to steel, greatly retards corrosion. Thus a much longer life is assured than ordinary steel ties can give—extra service without additional cost to you.

Aside from their economy through exceedingly long service, Carnegie Ties recommend themselves to users for many other reasons. They are light and portable. Their shallow depth saves headroom. They are made in a number of styles with single or double locking clips as you may prefer. The clips are riveted to the tie and cannot get lost. A hammer blow is all that is necessary to firmly secure the rail, automatically true to gauge. No special tools or fittings are needed. The ends of the ties may be crimped if desired, to prevent slipping.

We have endeavored to give you exactly what you want—an efficient mine tie at a price that insures ultimate economy. The popularity of Carnegie Copper Steel Mine Ties indicates a goodly measure of success.

*Descriptive booklet on request.*

CARNEGIE STEEL COMPANY  
*Subsidiary of*  
UNITED STATES STEEL CORPORATION  
PITTSBURGH, PA.



## CARNEGIE MINE TIES



## Gentlemen— You have a responsibility toward that equipment

When you purchase a machine or equipment you expect it to accomplish certain results. The manufacturer has undoubtedly guaranteed that his product will meet your requirements; he may have demonstrated that it will.

In spite of guarantees and demonstrations no machine can be expected to give its rated service without proper care; and most important in the care of equipment is adequate and correct lubrication. Only by correct lubrication can friction be reduced to a minimum; only by the use of the right grades of lubricants can equipment be expected to function at its rated capacity and give a profitable length of service.

Frequently, to obtain correct lubrication, a careful investigation by experts is necessary. They study the mechanical construction and the operating requirements of each machine, the speed at which it operates, pressures maintained, heat encountered and other factors which must be considered in order to determine the proper grades of lubricants to use.

Our lubrication engineers will welcome an opportunity to make a survey of your plant—free of cost, and without placing you under any obligations. They may be able to show you savings well worth while.

*Just phone or write our nearest  
branch office*

### STANDARD OIL COMPANY (*Indiana*)

General Offices: 910 South Michigan Avenue

CHICAGO, ILLINOIS

ILLINOIS  
Chicago  
Decatur  
Joliet  
Peoria  
Quincy

INDIANA  
Evansville  
Indianapolis  
South Bend

KANSAS  
Wichita

WISCONSIN  
La Crosse  
Milwaukee  
Green Bay

IOWA  
Davenport  
Des Moines

Mason City  
Sioux City

S. DAKOTA  
Huron

N. DAKOTA  
Fargo  
Minot

MICHIGAN  
Detroit  
Grand Rapids  
Saginaw

MINNESOTA  
Duluth

Mankato  
Minneapolis

MISSOURI  
Kansas City  
St. Joseph  
St. Louis

5012

# Cut compression costs with G-E Motorized Power

Here's economy, exemplified by G-E compressor drive. Compression costs—always important items of expense—are minimized when G-E motors and G-E controllers are used. High efficiency that cuts the power bills; reliability that eliminates reserve units and reduces maintenance; and, where synchronous motors are employed, power-factor improvement that further lowers power costs and sets investment at a lower figure—all these combine to promote compression economy.

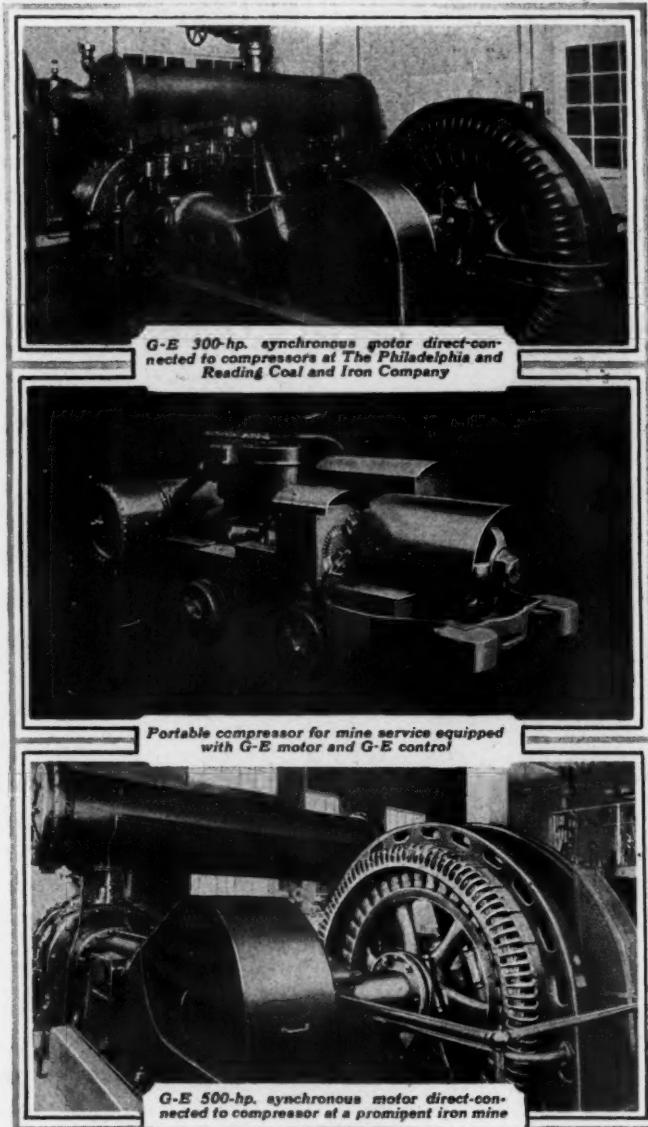
General Electric supplies complete electric equipment for mine service—from push-button stations to power plants.

Consult your nearest G-E office for advice on any problem in mine electrification.

Apply the proper G-E motor and the correct G-E controller to a specific task, following the recommendations of G-E specialists in electric drive, and you have G-E Motorized Power. Built in or otherwise connected to all types of industrial machines, G-E Motorized Power provides lasting assurance that you have purchased the best.



**Motorized Power**  
-fitted to every need



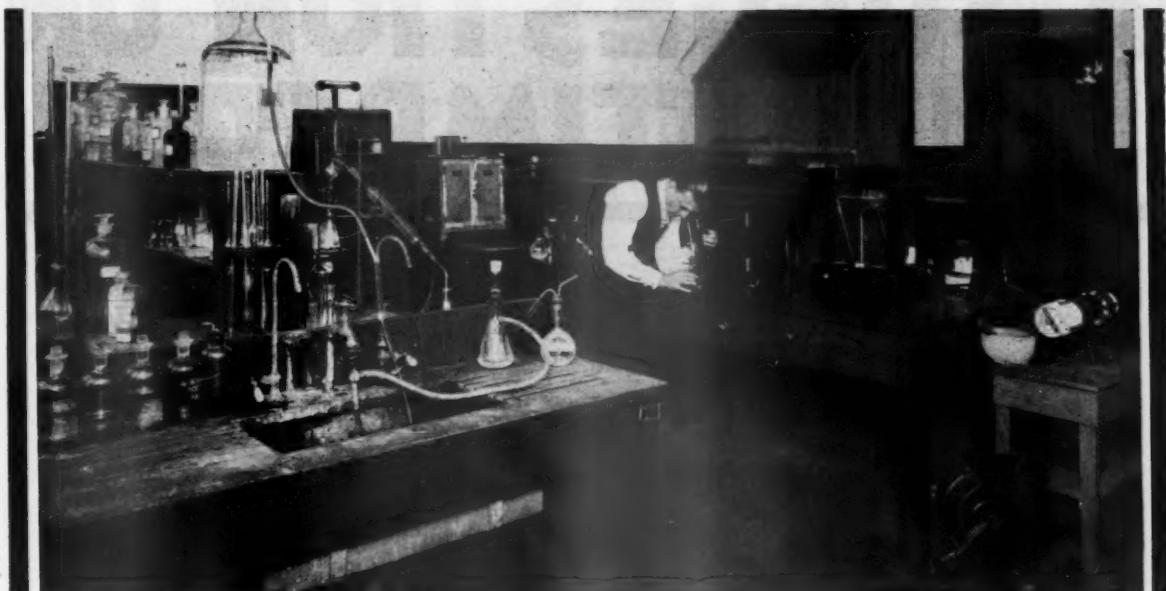
**GENERAL ELECTRIC**  
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

107-31

◆◆ BEHIND THE PYRAMIDS—1 ◆◆



## Continually in Control ... the LABORATORY



WHEN we say that National Pyramid Brushes are a laboratory product we do not mean that they are merely designed by our engineers and scientists. Our laboratory goes far beyond design. It is actually in complete and final control of all raw materials, of each manufacturing process, and of the final finished brushes. Every material and every process must meet rigid specifications. Nothing that fails to pass these specifications can be used.

The very first step in the manufacture of National Pyramid Brushes is the purchase of the oil from which lampblack is to be burnt. This oil is bought under close specifications, and each shipment is tested by us to make sure it follows those specifications in viscosity, flash point, residue, and chemical composition.

The lampblack produced from this oil is tested for volatiles and ash, the latter being held down to a few hundredths of one per cent. All other raw materials—pitch, graphite, copper and other substances—are similarly tested with the utmost care and precision.

In the long manufacturing process, frequent samples are analyzed by the laboratory. Machine operation is closely watched. Furnace temperatures are governed by pyrometers.

Many more than 36 scientific controls are exercised by our laboratory over the 36 major manufacturing operations in our factories.

National Pyramid Brushes are as scientifically made and as uniform as are the electrical machines on which they are used.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide  and Carbon Corporation

Carbon Sales Division



Cleveland, Ohio

San Francisco, Cal.

Branch Offices and Factories

Chicago, Ill. Pittsburgh, Pa. Jersey City, N. J. Birmingham, Ala.

Many mine owners have failed to seriously consider the treatment of their timber, on account of the necessary expense incident to installing a treating department of their own. However, it is only in rare instances that a private plant is necessary or advisable.

# A SUGGESTION ON MINE TIMBERS



Everyone concerned in permanent Timber preservation will be interested in a new edition of the booklet — "ZINC META ARSENITE"—which is a technical discussion in three parts. It will be sent free upon request.

\*\*\*

We shall also be glad to send a reprint of a recent article prepared by a specialist in wood preservation, which shows the actual dollars and cents value of mine timber preservation.

Many long established and dependable treaters are in operation in various parts of the country, who are in a position to treat mine timbers by the most improved methods at a cost no greater than if done by the treating department of a mine company.

For detailed information as to prices, or how ZMA treated timber can benefit you, communicate with any of the plants listed here, or write direct to Curtin-Howe Corporation.



*Some strategically located plants  
treating with ZMA*

Canada Creosoting Co. . . . .	Montreal, Canada
Eppinger & Russell Co. . . . .	New York
Gulf States Creosoting Co. . . . .	Hattiesburg, Miss.
Joyce-Watkins Co. . . . .	Chicago, Ill.
Keystone Wood Preserving Co. . . .	Philadelphia, Pa.
Piedmont Wood Preserving Co. . . .	Augusta, Ga.

## CURTIN-HOWE CORPORATION

TIMBER PRESERVATION ENGINEERS

11 PARK PLACE

Crozer Bldg.  
Philadelphia, Pa.

NEW YORK CITY      New Orleans Bank Bldg.  
New Orleans, La.

AMERICAN CABLE COMPANY, INC.  
"TRU-LAY BRAND" WIRE ROPE SERVICE REPORT

100-4-2 100-4-100

IMPORTANT PLEASE NOTE—2 Copies of All Service Reports are to be submitted direct to Sales Office, N. Y.

COPY NO. 1 This Copy To Be Filed Alphabetically under Customer's Name.

Name of Company \_\_\_\_\_ (Name and address given on original report. You can have it on request.)  
Address \_\_\_\_\_  
Where Used \_\_\_\_\_  
Name of Official in Charge of Test \_\_\_\_\_

Report No. \_\_\_\_\_  
Date 9-2-1928  
District Philadelphia  
Cust. Ord. No. \_\_\_\_\_  
Mill Ord. No. \_\_\_\_\_

TRU-LAY:

SERVICE HOURS		Cost per Service Hour	Cubic Yds Excavated
Average Service	858	\$ 0.1547	20799
Maximum Service	899		20024
Average Service	223	0.1357	50805
Maximum Service	805		

COMPETITORS

Make of Competitor's Rope (On request)

ROPE DATA

TRU-LAY 250' length Size 1/4" Construction 0 x 27 Grade —

COMPETITOR'S 250' length Size 1/4" Construction Grade —

Type of Equipment Rope Used on (Give full description) Power Dragline Shovel  
Electrically operated

Rope Used As (Give full detail) Dragline digging in coal

Signed B. E. Hollifield  
Philadelphia Office  
Philadelphia, Pa.  
Sketch on reverse side of this sheet showing Rope Reelings, Sheave Grooves and Drum Dimensions  
Note: Submit Drawing in  
meters, etc.

**Cost cut**



# Cost cut

This report of Tru-Lay service is typical of the savings that are being made wherever wire rope is used. It will pay you to investigate Tru-Lay Wire Rope economy. Your name and address bring a sample and complete information.

## AMERICAN CABLE COMPANY, *Incorporated*

## Grand Central Terminal Building, New York, N. Y.

*District Offices: Chicago, Detroit, Philadelphia, Pittsburgh, Tulsa, San Francisco*

An Associate Company of the American Chain Company, Incorporated

**Dominion Wire Rope Company, Limited, Montreal, Sole Canadian Licensed Manufacturers**

# PREFORMED WIRE ROPE

# TRADE MARK





## TRADE

MARK



#### **Detroit International Bridge**



#### Philadelphia-Camden Bridge, The World's Greatest Suspension Bridge



---

**Mr. Hope Bridge, Bristol, R. I.**

---

American Cable is used on the World's Greatest Bridges.



## Where work must go on—

SAFETY and efficiency demand good light. Carbic Flood Lights make night work productive. Steady and powerful rays of Carbic light insure the job proceeding with day-like rapidity and safety.

The Carbic Flood Light is simple. There are only three parts. It has unusual safety features. Any inexperienced laborer can charge it in a few minutes. A charge lasts twelve hours. The Carbic Flood Light is low in first cost and inexpensive to operate.

*Speed up your job by working  
at night with*

## CARBIC LIGHT

OXWELD ACETYLENE COMPANY

*Unit of Union Carbide and Carbon Corporation*

NEW YORK CITY:  
30 East 42nd Street



CHICAGO:  
Peoples Gas Building

SAN FRANCISCO: Adam Grant Building



Carbic is distributed by the Union Carbide Sales Company through its national chain of warehouses and is sold by jobbers everywhere.



*'The odds  
were against  
me, but  
I stood and  
told them what  
they ought  
to know'*

— said the Consulting Engineer  
of a large Industrial Corporation

*"I told them* my recommendation of Byers Pipe was based on actual experience of practical users in their own community."

*"What was the outcome?"*

"Oh, they installed Byers—every foot of all the lines that are subject to corrosion, just as I advised. You see, I didn't commit myself till I had the facts of the case well in hand."

*"Just what difference did you tell them they might look for, between Byers and the ordinary merchant pipe?"*

"For use like theirs, in their locality, Byers will probably give double the service."

*"And what's the difference in cost?"*

"In their case, about 4%. Anywhere from four to eight percent is what we find. You see, first class wrought iron pipe, merely as pipe, may cost 40 to 70% more, depend-

ing on the sizes. But that applies only to pipe, in the jobber's warehouse, before you've started to do a thing. By the time your job is completed, pipe represents perhaps 10 to 15% of what the installation has cost you. Now suppose you could cut that to half, by using cheap pipe. You never can, quite; but suppose you could. It's only one small element of cost that you're cutting, remember; and you're cutting down the life of your whole investment in the system involved."

*"Do you really mean that?"*

"Yes, every bit. The labor cost of replacing pipe in case of failure isn't going to be any less than it was on the original installation. Usually it's more—often double; and your salvage of valves and fittings is negligible, as a rule. So, when you

get pipe to last twice as long, you are getting a 100% added value, for a 5% increase of cost."

*"I should like to see some figures of actual cases."*

"The Byers people have them. Just say you want the bulletin on the Installed Cost of Pipe."

**A. M. BYERS COMPANY**

Pittsburgh, Pa. *Established 1864*

*Distributors in all Jobbing Centers*

*Send for Bulletin No. 38*

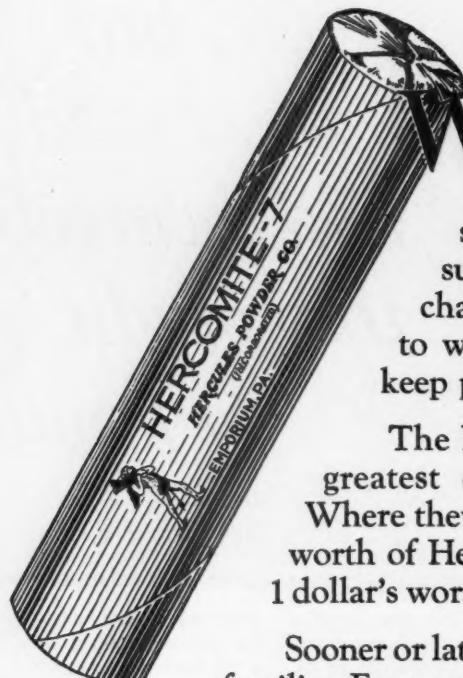
*"The Installation Cost of Pipe." Contains cost analyses of scores of heating, plumbing and other pipe systems. Shows the high cost of replacing rusted pipe and the folly of using cheap pipe.*



**BYERS PIPE**  
GENUINE WROUGHT IRON

TO THOSE WHO SAY . . .

# "Why Change Explosives?"



WHEN the work is running smoothly; when the men are familiar and satisfied with a powder, many a superintendent or buyer asks: "Why change explosives?" It's natural not to want to change, but progress must keep pace with improvement.

The Hercomites represent one of the greatest explosives values ever offered. Where they are suitable, 70 cents' to 90 cents' worth of Hercomites are successfully replacing 1 dollar's worth of Extra or Gelatin dynamite.

Sooner or later, many who now cling to the old familiar Extras, Specials and Gelatins will change to the Hercomites, to lower their blasting costs. Don't be among the last to benefit from the savings they effect. Write us for a descriptive booklet and investigate now.

For information on other explosives and blasting supplies, see pages 170 to 172 of the 1928 Keystone Metal Quarry Catalogue.

## HERCULES POWDER COMPANY

Wilmington, Delaware

Sales Offices: Allentown, Pa., Birmingham, Buffalo, Chattanooga, Chicago, Denver, Duluth, Hazleton, Pa., Huntington, W. Va., Joplin, Mo., Los Angeles, Louisville, New York City, Norristown, Pa., Pittsburg, Kan., Pittsburgh, Pottsville, Pa., St. Louis, Salt Lake City, San Francisco, Wilkes-Barre, Wilmington, Del.

Hercules Powder Company, Inc.

934 King Street, Wilmington, Delaware

Please send me additional information regarding the new Hercomites, No. 2 to No. 7.

Name \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

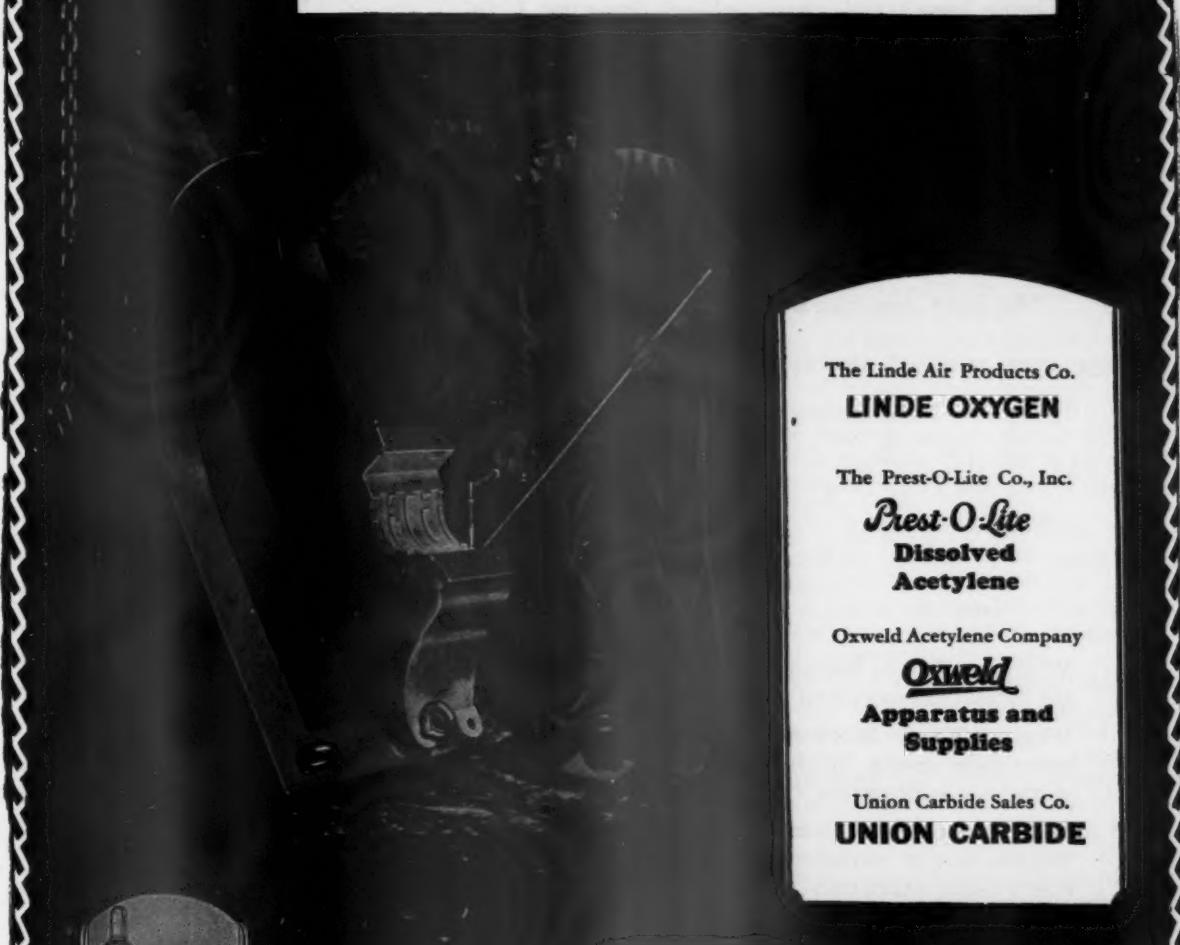


2282

# Everything for OXWELDING and CUTTING

*—wherever you are*

Gases, apparatus and supplies—are immediately available in every industrial section of the country through the remarkable distribution system of these associated companies, comprising 93 manufacturing plants and 467 warehouse stocks.



The Linde Air Products Co.

**LINDE OXYGEN**

The Prest-O-Lite Co., Inc.

**Prest-O-Lite**  
Dissolved  
Acetylene

Oxweld Acetylene Company

**Oxweld**  
Apparatus and  
Supplies

Union Carbide Sales Co.

**UNION CARBIDE**

*Units of*

**UNION CARBIDE AND CARBON CORPORATION**

*General Offices*

**UCC**

*Sales Offices*

30 East 42nd Street, New York, N.Y.      In principal cities of the country



"For the past three years we have been experimenting with Timken Tapered Roller Bearings on the armature shafts of our mine locomotives. We started this experimentation because of our belief that the Timken Bearing would overcome the difficulties experienced in the past with other types of anti-friction bearings.

"Our experiments to date are that we have eight locomotives equipped with Timken Bearings on the armature shafts and we have not had a single bearing failure during this time. This is indeed remarkable based upon our experiments in the same locomotives and same motors with other types of bearings that actually cost us more money and gave us less bearing life.

"In addition to the bearing life, it means that the lack of bearing wear has prevented the dropping of the armature and thereby prevents poling on the armature so equipped.

"We have two hundred locomotives in our mines and we plan to gradually change over most of the armature bearings to Timken Tapered Roller Bearings."

PENNSYLVANIA COAL AND COKE CORPORATION

*J. F. MacWilliams*  
Electrical Engineer

Why have Timken Bearings "overcome the difficulties experienced in the past"?

Why did Timken Bearings reverse the unfavorable results "in the same locomotive and same motors"?

Because only Timken Bearings combine Timken tapered construction, Timken **POSITIVELY ALIGNED ROLLS**, and Timken-made electric steel.

That is why all Mining knows Timkens as "more than anti-friction bearings"!

THE TIMKEN ROLLER BEARING CO.  
CANTON, OHIO

**TIMKEN** *Tapered*  
*Roller* **BEARINGS**

# The MINING CONGRESS JOURNAL

A Monthly Magazine—The Spokesman For The Mining Industry—  
Published By The American Mining Congress

6266

VOLUME 15

JANUARY, 1929

No. 1

## Editorials

### Nineteen Twenty Nine

WE WISH FOR OUR READERS AND OUR MEMBERS A YEAR OF PROSPERITY: A YEAR THAT WILL BE OUTSTANDING IN ITS RECORD OF COOPERATIVE EFFORT WITHIN THE GREAT MINING INDUSTRIES AND WE PLEDGE OUR BEST ABILITY IN ASSISTING MINING TO ATTAIN THOSE THINGS FOR WHICH IT IS SO EARNESTLY STRIVING: SAFETY, EFFICIENCY, AND CONSERVATION, TO BE ACHIEVED THROUGH COOPERATION.

*The American Mining Congress.  
The Mining Congress Journal.*

### Revenue Changes Bring Results

THE Commissioner of Internal Revenue reports that during the fiscal year of 1928 the work of the income tax unit was brought to a current basis. According to the report, "Production was the greatest in the history of the Unit. Conditions are such that the balance of cases on hand, including the 1927 returns, can be handled within the next 12-month period, and that a current tax audit can be maintained. Changes in organization and improved procedure contributed in large measure to the result, which was accomplished with a reduced personnel and at less cost than in prior years."

The report states that "During the year audit organization changes were perfected with the result that, except for the work upon special adjustment cases, all of the review of cases concerning which revenue agents and taxpayers fail to reach an agreement is performed in one audit division, under one general supervision." Under the new plan of organization and procedure, individual returns are audited by collectors' forces in the districts in which the returns are filed. Office audits are made in the revenue agents' offices in the field, and review officials have been placed in these field offices and

thus made available for consultation. Cases involving deficiencies in tax that are agreed to in the field are routed directly through the collectors' offices for listing and assessment, and the practice of forwarding these cases to Washington for such action has been discontinued. Many other improvements in organization and procedure are outlined in the report.

In 1921 and 1922 the American Mining Congress Tax Division, with the approval of the General Tax Committee of the organization, recommended, among other things:

(1) The creation of a Federal tax adjustment board.—The Board of Tax Appeals was created by the Revenue Act of 1924.

(2) Decentralization of the income tax unit by transfer of the audit of returns to collection districts.—This has been done for all practical purposes.

(3) The formation of a board of reviewers or referees in each collection district.—Review officials have been assigned to the offices of revenue agents in charge of field offices where conferences are held.

(4) Provision for holding conferences on disputed items in the district in which the taxpayer is located.—The Commissioner's report shows this plan is working satisfactorily.

(5) Consolidation of the audit sections in the Washington office to eliminate duplication of audits.—All audits are now under one supervision.

(6) Abolishment of the review division of the income tax unit.—Cases are now reviewed in the section or field office where they are audited.

Taxpayers generally will enjoy the advantages that will accrue to them as a consequence of the new practice. In the case of deficiencies in tax, the period during which interest accrues against the taxpayer is materially shortened, and at the same time government collections are made more promptly. The opportunity afforded taxpayers for conferences in their local districts results in a great saving of time, expense and uncertainty. Doubtful items or deductions in the returns may now be settled at these conferences and final action stated.

The Commissioner of Internal Revenue and his administrative assistants who have, during his administration, slowly but surely brought about the improvements outlined in the organization, procedure and practice of the income tax unit, are to be highly commended for their achievements thus far. While much remains to be done in perfecting the income tax system, further improvements in and simplification of the law itself must be brought about before the administrative system can be made a perfect machine in the assessment, adjustment, and collection of taxes of the mining industry.

**Why Associations?** **W**ITH the multiplicity of associations in all industry, the question is frequently asked, "Why associations?" What do they do to justify their existence and their cost to industry and, ultimately, to the consumer of the product they represent? A. Lincoln Filene, chairman, Research Committee, of the Associated Industries of Massachusetts, in an editorial symposium explains the purpose, the advantages and the helpful results that may be obtained through associations. We quote the editorial in full, because it expresses our ideas on the subject.

"The basic purposes of organization or association among industries is cooperation and exchange of ideas and economic information. The members—and the public—benefit in direct proportion as the association succeeds in achieving these two fundamental aims.

"More specifically, the public benefits from cooperative association of any sort in industry in four general ways.

"1. When cooperative research or pooling the benefits of individual research—that is, the interchange of new ideas—makes possible a better product at the same or lower price.

"2. When cooperative action affects distribution economies tending to make possible for the public better service or lower price or both.

"3. When these activities bring the component concerns more business, thus benefiting the community in stability of employment, more wages, greater purchasing power—in short, more prosperity.

"4. When the association, acting as a unit, is enabled to protect or aid its component members or otherwise promote their continued production of wealth."

#### **Business Self-Government**

**I**N order to regulate the practices of any part of the business world for the purpose of eliminating and preventing trade abuses, the Government must necessarily create some agency to perform that function. Such a regulatory agency of government can not avoid interference with business in the exercise of its powers. We believe that the impulse to further expansion of governmental activities is misdirected. We believe that in most instances trade abuses and difficulties can be adjusted better by the business world itself without legislation and governmental control than with such measures. Instead of seeking a sort of governmental guardianship or paternalism over the affairs of business that are not being satisfactorily conducted, each section of the business world should "search its own soul as to whether or not it is performing its best service to the public as a whole and thereby making it free from any suggestion of need of control."

This idea apparently is finding favor. Comment upon this question in a recent address before the National Crushed Stone Association, Mr. Gilbert H. Montague, of New York City, said:

"Never has the Government gone so far as during the past year in its encouragement, support and enforcement of business self-government by business and trade groups. One industry after another, in trade conferences called by the Federal Trade Commission, is today adopting rules for eliminating trade abuses, which rules are all registered with the Commission, and are daily being enforced with all the strength of the Commission's

authority behind them. \* \* \* Business ethics are created, not by laws, but by the opinion of business men. All the laws in Christendom are powerless to raise the business standards of a single industry above the level reached by the preponderance of public opinion among the reasonable and fair-minded men in that industry. \* \* \* Business self-government, simply because it is self-government and not government imposed from an outside authority, is creating for business higher standards and more rigorous enforcement than have ever been attained either by the governmental authorities or the courts."

When all sections of the business world come to realize that the improvement of business standards is a responsibility and a duty of the business world rather than a function of government, there will be an end to the general rush to Washington to secure a law on this and that subject, such as is manifest in the fifteen thousand bills that are presented at each session of the Congress.

#### **The Closing Session**

**T**HREE is every reason to believe that the final session of the 70th Congress will confine its activities to routine business and that it will dispatch that business in the shortest order. The result of the election precludes any further consideration of the equalization fee provided for in the McNary-Haugen bill, and there is little likelihood that legislation of controversial nature will occupy the time of the Congress.

Appropriations must be made. The business of government must be attended to. The 70th has been a stormy Congress, and its record is one of strife and stress. It has accomplished some legislation that is required and is necessary. It has considered innumerable bills. With its passing, many of the faces that have been familiar will be there no longer. But as the run of Congresses go, the 70th is no better and no worse than any of its predecessors. If it wishes to leave a kindly feeling in the hearts of industry, if it wishes to enhance its memory, it may do so by sticking strictly to its knitting and dispatching the business of government in record time.

#### **The Special Session**

**B**USINESS in the United States has learned to fear the special sessions of Congress. President Coolidge has consistently refused to call such sessions, although the pressure brought to bear upon him has been tremendous. The effect of special sessions has always been bad. If any such session might be confined to a specific subject, the effect might not be so disastrous, but there is no limiting the number of subjects that may be brought up and the time consumed.

At present the farm relief issue is the only justification offered for calling a special session. Farm relief proponents in Congress believe that issue can be disposed of at the present short session. Those who want to put the Government into the manufacturing and distributing business at Muscle Shoals and elsewhere will, of course, quibble and equivocate about every question that comes up, especially farm relief, in order to make a special session necessary. But if the farm relief advocates are wise, they will put through a program that will make it possible to avoid a special session.

It may be that Mr. Hoover has good and sufficient reason for pledging a special session next summer. But no one knows better than himself just where it may lead.

### The Tariff Commission

THE report of the United States Tariff Commission shows that body well organized to perform the investigatory duties reposed in it by the tariff laws. The data gathered by the Commission for the information of Congress undoubtedly will result in intelligent adjustments of the tariff schedules by the next Congress. The Committee on Ways and Means will have before it careful analyses of the effect and operation of practically every schedule of the Tariff Act, prepared by the Commission, as well as testimony to be presented at the hearings before that committee during January and February.

In addition to gathering exhaustive information respecting economic and competitive conditions affecting American trade and industry, the Commission, during the last year, has submitted reports to the President on 28 items or commodities covered by the Tariff Act of 1922 on the basis of which the President has proclaimed increases or decreases in the duties under the provisions of Section 315 of that Act.

The American Mining Congress has never approved the flexible provisions of the tariff law because of the unstable conditions and uncertainty created by the ever-present possibility that duties may be changed without action by Congress with resulting disturbance and possible serious injury to some branch of industry. While thus far, it may be shown that these provisions have afforded a justified measure of relief in a number of instances, it is believed that, in general, to repose such powers in any agency other than Congress itself is more likely to be harmful than beneficial. An industry requiring a large investment to equip itself for economic operation would be reluctant to make the necessary expenditures for such equipment while confronted with the ever-present possibility that tariff protection might be removed and its investment thus made valueless.

However, the Tariff Commission has demonstrated its usefulness as a part of the tariff-making machinery of the government. The Commission has not permitted political considerations to govern its functions, and its policies have been conservative and sound in dealing with matters that have required the exercise of its powers. The data made available to Congress as the result of the numerous studies and investigations already completed by the Commission, will be invaluable to Congress in placing the tariff on a more scientific and effective basis for the protection and upbuilding of American trade and industry.

### The Tariff Hearings

HEARINGS on the tariff, preliminary to general tariff revision, will begin this month. Various industries will appear to ask for increases in the present duties. On the basis of the testimony of industrial representatives and data assembled through studies and investigations by the Tariff Commission, the Committee on Ways and Means will frame tariff legislation for the consideration of and action by the next Congress.

American industries should have protection sufficient to overcome the difference between cost of production at home and abroad and differentials in ocean and rail transportation rates to domestic markets. This is necessary, not only to the maintenance of domestic production and continuous employment for American labor, but also to sustain the high wage level and standards of living

that prevail in this country as compared with wages paid and standards of living in foreign countries. American wage scales and living standards are absolutely dependent upon adequate protection against the products of cheap foreign labor.

It is safe to say that Congress will not propose any action that will injure home industries or that will result in the deferral of expansion and development programs that are going forward in the American industrial world. The majority of the American people have emphatically endorsed the principle of the protective tariff. That principle will be adhered to. The intelligent desires of the American people will be satisfied.

### Creating Standards

ACCORDING to a statement from the Bureau of Mines, it has developed a method of rock dusting which is rapidly becoming standard practice. The bureau states that it has made a special study of rock dust barriers in order to determine which will be found most effective under various conditions. The bureau also announces that it is standardizing ventilation requirements of coal mines, gas and dust explosion hazards, and numerous other standard mining practice.

The word standards it seems to us is used inadvisedly in these releases, and creates an entirely wrong impression. Without in any way wishing to minimize the excellent work of the bureau, it is not a standardizing agency. A standard, as we view it, is not something that is arrived at arbitrarily and promulgated by a government bureau. It is the voluntary cooperation and acceptance by an industry of the best practice which practical experience has demonstrated as efficient and reliable.

The American Standards Association is the national standardizing body for industry. Through its facilities industry is permitted to create its own standards, the Association acting as the clearing house to prevent duplication and conflict.

In the mining industry, The American Mining Congress has long been the sponsor for standardization work, and has developed, through cooperation with the industry itself, and other agencies, a group of standards that are in daily use in the industry. The Bureau of Mines has cooperated in the formulation of these standards, but primarily, they have been developed by the practical mine operating official.

The demand for a set of rules governing standard mine operating practice came directly from the mine operator. Some 700 men, representing a progressive group of companies in the industry, have given considerable time, and contributed a vast amount of knowledge in the creation of these standards. And the results have justified the effort.

The Bureau of Mines has been extremely helpful in developing these standards. Their experts have cooperated with the committees, and the complete resources of the bureau have been at their disposal. Much remains to be done, and the industry hopes to have the continued cooperation of the bureau in its standardizing work. But it is well to keep in mind at all times the fact that in order for any so-called standard to be effective, unless through compulsory legislative measures, it must have the active cooperation of the industry to which it seeks to apply.

**An Exhausted Subject**

NO industry in the history of this country has ever received more prolific advice than has the bituminous coal industry. It has been the subject of debate in both houses of Congress, and its name has been upon the tongue of most of the public speakers who essay to be students of our national economic situation. A coal commission spent millions in an attempt to analyze this great industry. Bills by the dozens have been prepared by enterprising Congressmen; labor leaders have shouted the coal miner's distress from the housetops; operating men within the industry have presented their individual and collective views on "what is the matter with coal"; and what have we?

Nothing at all, except that harrassing the industry without will not solve its problems within. After thorough dissection, after years of painstaking study, the only real conclusion that seems to be anything like unanimous, is *let the coal industry alone*. Let it work out its problems unhampered with the restrictions of state and national legislation. Give the industry a chance to breathe.

Some writers insist that the problems of the industry are, after all, simple, and require only ordinary judgment, intelligently applied with sincerity and honesty. Its problems are not so simple, but even simple problems connected with a giant assume gigantic size. Its problems are as multiple as the units, geographic divisions, and individuality of this great industry.

**Keeping Ahead of Costs**

THE margin of profit between the bitterly competitive market for coal and the cost of production by the old time methods has been leading to nothing but losses to the coal operator. During recent years the increased use of hydro-electric power and oil in the development of heat and power, and the economies effected by better combustion methods, have brought about a decrease in expected coal markets, which has been disastrous to the bituminous coal industry. Until a few years ago the increase of coal consumption in the United States averaged 10 percent annually. In other words, in each ten years, the market for coal has been doubled. During recent years because of substitutes, and the economies referred to, the increase in consumption has average about 2 percent annually, while the coal industry has prepared itself to meet an increase of 10 percent. This situation has brought about a condition in the coal industry that is a serious one.

**What is the Remedy**

AT THE recent convention of the American Mining Congress one session was devoted to the problems of coal. The speakers were well informed men, thoroughly conversant with the industry they are a part of.

The sum-total of their advice to the industry is *Co-operate*. Their plea to the public is to be let alone. Their plea to the legislator is to stop harrassing coal with threatened legislation. And their definite conclusion is that the industry will right itself, if given any kind of a chance.

It may be insisted that the industry is having a chance, and that it has not yet done what it says it can do. But it should be remembered that it has been almost con-

tinuously on the defensive, that if it has not been engaged in conferences on labor matters, it has been defending itself before congressional bodies. At the present time it is busily defending itself against a bill before the Senate Interstate Commerce Committee, written by labor leaders, and which proposes legislation which would be highly inimical to the industry.

Again we insist that the coal industry can solve its own problems if given a respite from attacks from without, and is permitted to cooperate from within.

**Anthracite**

A. B. JESSUP, in an address before the recent meeting of The American Mining Congress, painted a vivid picture of a great American industry. He told of an industry representing billions of dollars, and employing better than 150,000,000 men, being almost destroyed through the misguided direction of labor leaders, who brought about strike after strike, until the consumer weary of the struggle, undertook, successfully, to find a substitute.

Anthracite is again on the up-grade in spite of their difficulties, which include a wage scale that is even now war-peak, plus 10 percent, a tonnage tax of 15 cents per ton on domestic sizes, and general taxes that have increased in a period of but five years from \$5,600,000 to \$28,000,000.

The anthracite operators, through cooperative effort, are actively fighting a very real competition with low-volatile bituminous, coke, oil, gas and electricity. At one time in the history of this industry it had no competitors. But today it realizes that it is facing the most strenuous competition, and that it must be on the alert to hold its present markets, and must be on its toes if it captures new markets.

The efforts of this great industry to reduce costs, give a better product to the public, foster a better spirit in labor matters, and place the industry on a strongly progressive path, is told by Mr. Jessup in this issue.

**Thirty-three To One**

IT IS surprising that Uncle Sam takes so little heed of the value of his vast mineral resources. Little is said about them except here and there a voice crying out for conservation, or an investigation attempting to lay the foundation to enable the politicians to control them.

In spite of the fact that the mining industry employs approximately 2,000,000 men, and that more than 10,000,000 persons secure their livelihood from the industry, and that its finished products bring a revenue to the country of better than \$20,000,000,000 per year, and that the Federal government, from 1922 to 1926 derived 21 percent of its net revenue from the mining industry, Uncle Sam has been inclined to be forgetful, if not negligent, of his child.

Dean Frank H. Probert, of the University of California, points out all of these facts, and the further fact that in spite of mining's comparable status to agriculture in point of resource and revenue the government spends \$33.00 for agriculture every time it spends \$1.00 for the mining industry.

There are many reasons for this situation. Chief among them is the self-reliance of the mining industry. It has not made any great demand upon the government for assistance. It has asked the government to do only

those things which the government might do to better advantage than the industry. It has two bureaus in the government organization: the Bureau of Mines and the Geological Survey. These bureaus are capable of rendering great service to their industry, and should be fostered. The industry should see to it that they receive proper appropriations to carry on the work necessary for the advancement of mining, and there should be a spirit of hearty cooperation between these bureaus and the industry.

#### *Facts and Safety*

THE Bureau of Mines recently issued a statement upon the results of its safety activities. The report showed a step forward in the saving of life in the industry. While the favorable results were not startling, they do show that the intensive safety work of the bureau, coupled with the responsive cooperation from the industry, is beginning to show real results.

But how did the press treat the statement? In screaming head lines, they informed the world that "2,800 men killed in mining industry," and that "200,000 injured annually in mines and kindred work." Seare heads, all of them, and entirely misleading.

Unquestionably there are too many accidents in the mines. Unquestionably great improvement is imperative. And with full recognition of these facts we wish to point out that the industry is not standing still. The intensive effort of the Bureau of Mines in safety matters is being duplicated by the same intensive campaign in the various mining centers, and particularly by the individual companies.

Results are bound to be slow because of the personal equation. It is difficult for management to get the safety idea across to the individual worker. But it is being done, and while the results are not what the industry wants, is striving for, and will attain, the idea is taking very definite root, and is growing steadily. There are more than 2,000,000 individuals employed in mining, and while the percentage of killed and injured is altogether too large, when compared with other industries, the total does not seem too preposterous.

For the coming year renewed effort to establish a remarkable safety record will be one of the real goals of the mining industry.

#### *Will Hoover Administration Intervene in Business?*

Mr. Hoover's administration than it did in those of Presidents Harding and Coolidge." He refers to railroad consolidations, farm relief, tariff changes, water power, inland waterways, and public utilities as problems upon which the Hoover administration will be compelled to take some positive action.

It is probably true that legislation will be enacted during the next four years dealing with all of these problems. This does not necessarily mean that the government will intervene in business. To "intervene in business" as we interpret this phrase, means that the government will take some active part in business, or some active control of business through regulation or otherwise, or will go into business for itself. We do not believe that any such thing will happen under the Hoover administration.

**COLONEL LEONARD P. CAYRES**, Vice President of the Cleveland Trust Company, predicts that "the government will almost surely intervene in business much more during

Government intervention in business, as we understand it, means further centralization of our government, that is, the exercise by the Federal government of some authority or control over the management and practices of business or to go into a business of its own in competition with private enterprise. President-elect Hoover has never been an advocate of further centralization of our government. His speeches over a period of many years have indicated that he is opposed to that theory of government. We believe he will resist efforts of self-styled progressives to have the government interfere with various parts of our economic machinery.

It may be that in a case of serious public grievance against some section of the business world due to a disclosure of unfair business practices, the government will take some step toward regulatory action. In such a case, as in previous situations of this kind, the legislation authorizing regulatory action was supported not only by the general public but by a very large majority of the business world. This sort of legislative action is not, strictly speaking, intervention in business.

We believe that the business of the country can rest assured that its hands will not be tied, nor its markets destroyed, nor its management hampered, nor its investments threatened, by changes in the tariff, by the introduction of any form of government ownership and operation of water power resources or public utilities, or by any other measure of legislation designed to enlarge and centralize the functions of the Federal government at the expense of limiting or throttling initiative of private management and expansion of private enterprise. In other words, we believe that legislative measures dealing with business affairs, and affecting the economic structure of the country, will be considered solely from the standpoint of whether or not they will enlarge the progress of business and the opportunities for business expansion, and thus promote general business prosperity, in the interest of the general welfare of the people of the nation.

#### *The Ownership Of Industry*

THE phrase "Public Ownership of Industry" instantly brings to mind the thought of politician ownership — Government ownership.

But the phrase is susceptible of an entirely different interpretation, and, as a matter of fact, its true meaning is in literal force in this country today. Ownership of industry directly by the people through stock and bond holdings is an established fact, and is the only true "public" ownership that can ever be successful in a Democracy.

Stone and Webster and Blodget, Inc., in a recent publication make the amazing statement that Americans are now investing \$1,000 per second of every business day. A total of \$34,806,783,000 was invested in 36,965 different issues of bonds and stocks in the years 1923 to 1927, inclusive. They estimate that during a period of 15 years the growth of the public ownership of industry group has increased from approximately half a million to fifteen million investors, or an average of one person in every eight.

Such ownership of industry should be encouraged, because it is the only sound method of national growth. Stock ownership is being made possible by many great industrial enterprises, and those who have sponsored the plan over a period of years are vastly pleased with its result.

# The IRON ORE INDUSTRY and SOME of ITS PROBLEMS\*

By S. LIVINGSTON MATHER †

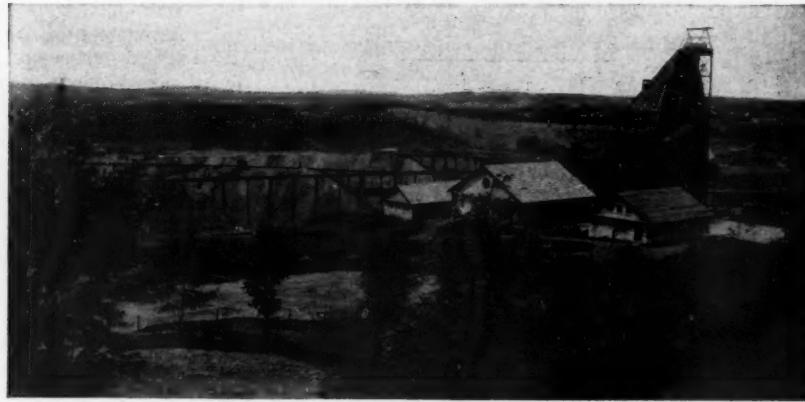
*The Problem Of Properly Adjusting The Inequalities In Taxation Of Minerals Is A Major One With The Iron Ore Producer—Problems Of Production, Transportation And Distribution Discussed—Cooperation With Other Industries Urged*

THE principal part of the iron ore mining industry of this country is located in the Lake Superior District, in the States of Minnesota, Michigan and Wisconsin, although there are considerable deposits of iron ore in Alabama, Colorado, New York, and other states. This paper is, however, a discussion of the Lake Superior part of the iron ore industry, as the history, mining methods and problems of the other districts are varied, and perhaps differ from those of the Lake Superior District, and not being familiar with them, I am not attempting to comment on them.

Iron ore was first discovered in the Lake Superior District between the cities of Ishpeming and Negaunee, Mich., in 1844. By 1850 several iron ore mining companies had been formed, and in 1852 the first six tons of iron ore were shipped, in barrels, to Cleveland, Ohio, which constituted the first shipment of iron ore from the Lake Superior District. The early shipments were hauled through the woods over corduroy roads in wagons to Marquette, loaded into boats, unloaded at Sault Ste. Marie, transported past the rapids, and again loaded into boats, and taken to Cleveland, from which point the ore was distributed to the furnaces in Ohio and Pennsylvania.

In 1855 the first canal at Sault Ste. Marie was opened, and in 1857 the Iron Mountain Railroad was built, from Ishpeming to Marquette, Mich., on Lake Superior, and seven years later the Chicago and Northwestern Railroad completed a branch from Ishpeming to Escanaba, thus opening a shipping outlet via Lake Michigan.

\* Presented to Thirty-first Annual Convention of The American Mining Congress.  
† Vice President, The Cleveland-Cliffs Iron Company, Cleveland, Ohio.



*Holmes Mine, Cleveland Cliffs Iron Company, Ishpeming, Mich.*

In 1877 the first shipments of iron ore were made from the Menominee Range; in 1884 the first shipments were made from the Gogebic and Vermillion Ranges. Then the Mesaba Range was discovered—the first shipments being made in 1892, and the first shipments from the Cuyuna Range in 1911.

The Baraboo District and the Mayville District, in Wisconsin, as well as two or three small Canadian Districts, have contributed to the production of ores from the general Lake Superior District so-called. The tonnages, however, have been comparatively small, part of the shipments going all rail.

The following table of tonnages, showing the average annual shipments by decades, illustrates the growth of this iron ore industry:

1858 to 1867 inclusive.....	179,128 tons
1868 to 1877 inclusive.....	880,821 tons
1878 to 1887 inclusive.....	2,548,047 tons
1888 to 1897 inclusive.....	8,420,101 tons
1898 to 1907 inclusive.....	26,235,111 tons
1908 to 1917 inclusive.....	45,612,966 tons
1918 to 1927 inclusive.....	51,168,715 tons

Up to the year 1876 all the ore produced from the Lake Superior District came from the Marquette Range. The first mining here was done in shallow open pits, but as this ore was followed down it became necessary to mine it by underground methods, and aside from open pits of silicious ore, mined largely by quarrying methods, practically all of the Marquette Range mining is by underground methods.

With the exception of the Mesaba and Cuyuna Ranges, the ore on the other ranges, for the most part, is also won by underground methods. The ore on the Mesaba Range being relatively shallow and located directly under the sur-

face overburden or a thin capping of rock, is made accessible and largely mined by open pit operations, although small tonnages even on this range are mined by underground methods. A number of open pits have been opened up on the Cuyuna Range, and two on the Gogebic Range.

As in other industries—there has been keen competition in the mining and selling of iron ore, and in the underground operations tremendous strides have been made in the economical production of ore, especially in the last 10 or 15 years. This is noted in the increase in size of hoisting equipment, making it possible in some cases to hoist as much as 10 tons of ore in a single skip, where less than one-half of this amount was the maximum 15 years ago, and prior to that time the skip capacity had been doubled approximately every 15 or 20 years. Electric haulage has been largely substituted for man and mule power in underground tramping of ore, and underground mining machinery generally, including pumps, hoists, compressors, etc., has been largely electrified. The drill machines and the quality and temper of steel used in drill bits have been steadily improved. During recent years mechanically operated scrapers have been developed and installed, replacing the old hand shovel in the loading or underground cars. Close attention paid to the schedule of the various operations has resulted in the decided increase in efficiency of the men themselves by standardization of the various operations; increased efficiency in the use of explosives and the way they are handled, and the methods of mining themselves with relation to their adaptability to the particular type

of deposit have largely aided in lowering the cost of production. Last, but not least, the attention given to the safety of the men employed in underground operations has been a material factor in increased efficiency and lessening of danger and delays from accidents.

This evolution, together with the careful management by the operators of underground mines, and the advantage in transportation rates, has enabled the best of the underground properties in Michigan to still compete with the large open pit operations of Minnesota, but there has been a steady increase in the amount of ore shipped from the open pits. The tonnages previously referred to show the steady increase of ore shipped from the Lake Superior District, but the principal part of this increase has been due to increases in open pit operations, and the developments here have been even more remarkable. This is illustrated particularly in the steady increase in the size of equipment used, from the early steam shovel handling but a yard or two of material at a time, and being able to load into cars on tracks but a few feet higher than their own level, to the mammoth steam and electrically operated shovels of 350 to 400 tons in weight, which handle from 8 to 10 cubic yards of material at a time, 15 to 20 tons of ore can be loaded into cars on tracks at an elevation of from 40 to 45 feet above them. The increased size and power of locomotives permits the handling of larger tonnages of ore with each load hauled out of the pit, and numerous other minor developments have increased the efficiency and economies of open pit operations. In the early days open pits were developed of comparatively small size with tracks on steep grades and heavy curves spiralling down into them. As the operators grew more assured of the ultimate success of their operations, they became more willing to undertake in advance large stripping programs, which permitted the laying out of tracks on easier grades, with less curves and more economical advance development of the operations.

In the early days it was only found practical to remove a comparatively small amount of overburden in order to mine the ore by open pit methods, but now it is frequently possible to remove two or more cubic yards of overburden to secure one ton of ore. A great many of the present large open pit operations on the Mesaba Range were at first opened up by underground methods, but the rapid strides noted above subsequently made it more economical to remove the surface overburden from these ore bodies and conduct the mining through open pits. The hydraulic method of stripping this overburden has also come into use in a number of localities

where the character of the surface permits it, not only where hillsides slushing can be carried on with the aid of the natural contour of the ground but also by washing the surface material into a sump and pumping it out—gravel and small boulders as large as 5 or 6 inches being handled in this way. The hydraulic work has been principally confined to the Cuyuna Range, but recently some hydraulic stripping has also been done on the Mesaba Range.

In the early years on the Mesaba Range only the high grade or so-called direct shipping ores were mined, but gradually methods of treatment have been developed for the sandy ores in the western half of the range, and washing plants have been constructed, having from 60 to 70 percent ratio of recovery to treat these lean sandy ores, and a high quality of concentrates is now turned out in these plants which is readily salable. The first concentrating plant was constructed in 1905, and the improvement in the machinery in this beneficiation process has been steady over the past 20 years, and it is reasonable to assume that still further improvements will be made which will render available larger and larger tonnages of the so-called low-grade ores.

Magnetic methods of concentrating, coupled with a roasting process, have been developed to concentrate the lean ores on the eastern Mesaba Range. These ores are extremely hard, but in order to permit them to be roasted and separated it was necessary to crush them and roll them down to a very fine product, which is expensive, and the present low price of iron ore does not now permit this method of concentrating ores to be conducted at a profit, although still further experiments are being made which will render these ores available for use in future years, although perhaps not before the major portion of the better ores has been shipped.

The constantly growing production of iron ores of the Lake Superior district has also been accompanied by a parallel development in the equipment which transports this ore from the mines to lower Lakes. The old-fashioned wooden railroad cars have been superseded by large quick-dumping hopper cars, holding from 75 to 85 tons, made up in trains with as many as 175 cars, to carry the ore from the mines to the ore docks on the shores of the Lakes. The old wooden ore docks have been largely replaced by splendid reinforced concrete docks, having several times the capacity of the old docks, with ample yard and track facilities for assembling different grades of ore, and dumping them quickly into the docks, and the time of loading the steamers has also been materially decreased through improvements in dock

handling methods, so that even although the steamers themselves have largely increased in their average size, the time of loading and unloading them has been steadily decreased.

The old wooden freighters have been entirely replaced, so far as the ore-carrying trade is concerned, by steel boats. The first steel freighter, built in 1886, had a capacity of 2,700 tons. By 1905 the largest boats had reached a capacity of 10,000 tons, and in 1928 two record cargoes were carried—one of 14,178 gross tons of ore to Lake Erie, and the other of 15,044 net tons of coal up.

Probably there has been no development more marked than the unloading equipment at lower lake ports. In spite of the steady increase in the size of the freighters above referred to, this machinery is now capable of unloading these large freighters in from four to five hours. With the despatch at the upper and lower docks, and with the channels of navigation so well marked and controlled by the Government, a modern boat can make the round trip from the head of Lake Superior to Lake Erie in from 6½ to 7 days, going up light, and from 8½ to 9 days when carrying a load of ore down and a load of coal up.

It is difficult to obtain any reliable figures as to the savings in the cost of mining operations today as compared with, say, 20 years ago, although it is known that they are very large. The principal reason for this is that a large part of the ore now being mined is being mined with a larger amount of overburden removed in the case of open-pit ore, or from greater depths in the case of underground mining, some of which mines are now over 2,800 ft. deep, one shaft being down to a depth of over 3,000 ft. The wages are now practically twice as high as they were 20 years ago, and the cost of materials and supplies have also a ratio of about 2 to 1 to the cost of supplies 20 years ago. In spite of all these increases in the cost of operation, the average selling price of iron ore at the mine today is only 10 percent higher than the average was 20 years ago, and if it were not for the tremendous improvements and economies which have been effected in the operations, the mining companies could not now continue to operate.

The most marked increase in the cost over the past 20 years is the item of taxes, both state and Federal, and the companies engaged in mining iron ore in the Lake Superior district are unanimous in their opinion that they are paying far more than their just proportion of these taxes. With all the improvements which have been going on throughout the country, such as good roads, better schools and universities, better water and sewer connections, better fire and police

protection, and increased municipal, state and Federal expenses, it is only natural that taxes should increase, and, of course, with the increased cost of living and consequent increase in wages for Government employes, these increases in taxes are to be expected, and the iron-ore industry is willing and ready to pay its fair proportion of these increases. We strongly feel, however, that the legislators throughout the country can not have realized that the present taxation laws were working such a hardship on this industry, or the laws would have been modified to more nearly equalize the burden of taxation.

I have not at hand figures showing these increases for the industry as a whole, but taking a group of mines whose production and quality of ore is practically the same now as it was both 10 and 20 years ago, I find that the tax per ton has doubled from 1907 to 1917, and again doubled from 1917 to 1927, so that it is now four times as great as it was 20 years ago.

The states tax the ore when it is proven up in the ground. If, for instance, a mine has 10,000,000 tons of ore, and is producing at the rate of 500,000 tons a year, the state computes its value of the mine by valuing the first 500,000 tons at its worth in the ground that year and valuing the second 500,000 tons at its worth a year later, and so on, valuing the last 500,000 tons at its worth 20 years later. In this way the last 500,000 tons has been taxed each year for 20 years, and each 500,000 ton has paid a tax for an average of 10 years, and at the end of the 20 years the mine is exhausted and the property of no value; whereas a manufacturing concern having a plant worth, say, \$10,000,000 is taxed on the value of that plant each year for the 20 years, but has the full use of the whole \$10,000,000 of plant value each year for 20 years, and still has the plant left at the end of that period. This method of state taxation clearly has elements of unfairness. In addition to the above-mentioned taxes, some states have a group classification whereby they class farm lands at a certain percentage of their full value, and manufacturing plants at another percentage of their full value, and houses at another percentage, and mineral at another percentage—and the mineral is in the highest class.

There has recently been imposed in some states an occupational tax, whereby the iron-ore industry is taxed, in addition to all the other taxes, 6 percent on the difference between the theoretical cost at which the ore could be mined if everything operated perfectly, and the highest selling price which could be obtained for the ore if the company were fortunate enough to be able to sell it and if it could obtain that highest price. At

about the same time that this so-called occupational tax was levied, a royalty tax of 6 percent was imposed, which was intended by the legislators to be paid by the fee owners from the royalty which they received from the mining companies, so that theoretically the state expected to receive from the iron-ore mining companies 6 percent of their profits and from the fee owners 6 percent of their profits, but this law, although intended by the legislators to tax the royalty from the fee owners, has recently been held to be in reality a land tax, and therefore, like other land taxes, must be borne by the lessees, who are the iron-ore mining companies, so that they have to pay both the occupational tax and the royalty tax, which in effect results in a tax of approximately 12 percent of the theoretical profit which they may make; and in addition to all these taxes the Federal Government gets its 12 percent.

The Federal Government's tax is perfectly fair if it is possible to compute it accurately, since it is levied on all alike, but as a matter of fact it is extremely difficult to compute, particularly so on account of the items of depreciation and depletion entering into the costs. The state laws, as previously mentioned, put a penalty on the mining company developing its ore in advance, but if the ore is not developed in advance, even though it is known to be there, we face a difficult problem as to the amount of depletion which should be allowed.

The mining industry, as you gentlemen well know, is a hazardous industry. The geologists and mining engineers are gaining knowledge as the years go on—just as the doctors do—but frequently where every geological indication points to the existence of ore or the continuation of the ore bodies already known to exist a disappointment occurs, and even the best of geologists and mining engineers have been known to make mistakes. Consequently an investor is loath to pay for any individual deposit of ore what it is figured to be worth on its computed value, based on known tonnages in the ground, and in arriving at the price which he might be willing to pay for any ore body, he invariably figures on the possible and probable extensions of the ore body which are likely to be found, and therefore in making his purchase he made a liberal allowance for additional ore. On the other hand, mining engineers who are operators and who know the hazards of mining want to be conservative in their estimates made to their employers as to the tonnages in the mine, and the Government engineers have also tried to be conservative, with the result that the tonnages figured as of March 1, 1913, are now proving in many cases to have been unduly conservative.

The above are a few of the more diffi-

cult problems of the iron ore mining industry. The mining men throughout the country, and in fact throughout the world, have been aiding each other in improving their mining methods, and frankly discuss their mining problems with each other, so that the improvements made by one operator and by one industry are soon common property, and are used as far as they may be applicable in reducing the cost of other mines and other branches of the mining industry, but in the question of taxation much can be accomplished by frank and free discussion of the problems. Mining companies are ready and willing to pay their fair proportion of the taxes, but in the past it seems that there has been too much individual action and too little frank discussion of this whole problem. Twenty years ago each concern was content to handle it in its own way. Now the problem has become so complex that cooperation is essential to secure a fair solution of the problems.

I hope that in the next few years the American Mining Congress may find ways to better the situation, and the principal way in which it seems to me that this may be accomplished is by frank and free discussion of the whole problem. The problem is such a complicated one that I feel it can not be solved by immediate action. There appears to be no short cut and no all-healing balm which will cure all the troubles, but with a sincere desire on the part of the mining industry as a whole, it would seem as though these problems can also be solved. The country as a whole is busy with its own problems, and we can expect but little help from outside sources—not because they are not interested in our affairs but because they know too little about it to be able to judge what is fair—but if we in the mining industry can present the complicated picture in a fair and intelligent way, I feel certain that the tax inequalities above referred to will be ironed out and fairly handled by the legislators and various governmental authorities.

The 1928 edition of the Statistical Abstract of the United States, issued by the Department of Commerce, and increasingly complete and useful from year to year, eclipses all previous issues. It carries 32 groupings, with 795 statistical tables and an excellent index.

Outstanding facts related in the book are the activity of building construction, unparalleled in the history of this or of any other country; the betterment of railway service; expansion in the export of manufactured goods; development of commercial aeronautics; and special reports by Dr. Julius Klein, among which is noted Canada's emergence as the best customer of the United States.

IT has always seemed to me that the interests of the Government and the interests of the taxpayers in the payment and collection of income taxes are not as divergently opposed as is frequently pictured. In terms of generalities this must be true. Both must insist that our revenue laws be administered honestly, wisely, and well. This is axiomatic. But an agreement upon general terms is founded frequently upon misunderstanding, each side according to them the meaning most satisfactory to it, and there is no real meeting of the minds. Accordingly, even at the risk of trespassing upon the subject assigned to the gentleman who is to follow me this morning, I propose that we dissect somewhat the two interests, in an effort to ascertain, if possible, whether or not we are actually aligned upon the same side and attempting together to attain the same goal.

#### THE TAXPAYERS' DEMANDS

Omitting entirely all matters relating to rates or forms of taxes, it seems to me that taxpayers may properly expect—in fact, may properly demand—that an income tax law be administered so as to give without discrimination:

- (1) Prompt determinations;
- (2) Certainty and finality; and
- (3) A minimum of inconvenience to business operations and a minimum of expense.

I have purposely excluded a second reference to honesty, for this is too fundamental to even require restatement. There have been errors of judgment, errors of interpretation, and errors of application committed by both taxpayers and the Government. But the attitude of both must be founded upon the basic policy of honesty. We know that the Treasury personnel as a whole is honest. We are equally certain that taxpayers as a whole are honest. The fact that occasionally there appears an employee or a taxpayer unable to resist the apparent gains glittering in the mirage of crookedness (the numbers being really insignificant compared to the persons involved, notwithstanding the fact that a staff of highly trained agents is constantly on the alert) should not shake our confidence in the slightest.

\* Presented to Thirty-first Annual Convention of the American Mining Congress.

† Special Assistant to the Secretary of the Treasury.



## *The TREASURY ATTITUDE in the ADMINISTRATION of the INCOME TAX\**

By ELLSWORTH C. ALVORD †



*Taxpayers May Properly Demand An Administration Of The Income Tax Law That Will Give Without Discrimination Prompt Settlements And A Minimum Of Inconvenience and Expense*

#### THE TREASURY ATTITUDE

Let me turn now to the Treasury attitude toward the demands outlined above and to the methods by which we hope to show substantial accomplishments.

#### PROMPT DETERMINATIONS

The report of the Secretary of the Treasury submitted to Congress yesterday gives the present status of the work of the Bureau of Internal Revenue, bringing down to date the survey of the administration submitted by the Treasury to the Joint Committee on Internal Revenue Taxation last year. I will not bore you with the statistics. The work of the Bureau of Internal Revenue is upon a current basis, and there is every reason to believe that practically all current returns will be audited several months prior to the running of the statute of limitations. And, as you know, the period within which an assessment

of a deficiency must be made has been reduced by the 1928 revenue act to two years from the date the returns are filed.

Those of you desiring prompt determinations by the Bureau of Internal Revenue can assist materially by responding to the request of the revenue agent and by replying immediately to the 30-day letter you receive if the examination indicates a deficiency. Our experience shows that by far the majority of cases would have been closed promptly if your complete evidence had been submitted within a reasonable time after it was requested. We realize fully that you are not always responsible for the delay, for you have placed your case in the hands of an accountant or an attorney. I fear that some of the taxpayers' representatives are possibly more interested in delay than in prompt determinations, for frequently fees are governed by the time involved and the apparent size of the job. Consequently, I trust that you will permit me to suggest that you select your representatives with care and that you keep in touch with their activities as much as possible.

Those of you who have been involved in tax litigation or have cases pending before the Board of Tax Appeals and are facing litigation can well inquire as to what is being done toward obtaining prompt determinations of your cases. I believe that the adoption of a new attitude throughout the bureau toward the settlement of tax cases and the creation of new agencies to facilitate settlement will provide you with determinations which, although somewhat delayed, will be much more prompt than if litigation continues. Tax liabilities usually are not susceptible of absolute mathematically correct answers. If both of us appreciate this, the first obstacle to administrative settlement, as distinguished from settlement by litigation, will have been removed and a substantial step toward prompt determinations taken. Cases involving questions of fact can ordinarily be settled administratively, as soon as your facts are established. Accordingly, there has been established a committee known as the Special Advisory Committee, consisting of some of the best men in the bureau, to consider cases pending before the Board of Tax Appeals and involving questions of fact. The accumulation of cases (Continued on page 18)



*Robert E. Tally*  
Elected President of The American Mining Congress.  
Mr. Tally is general manager of the United  
Verde Copper Company.

# AMERICAN MINING CONGRESS HOLDS HIGHLY SUCCESSFUL CONVENTION



*Robert E. Tally Elected To Presidency  
—Government Officials And Members  
Of Congress Participate In Four-Day  
Program—Resolutions Adopted Look  
To Improved Industry—Mine Mechan-  
ization Conference Important Feature  
—Atlanta Selected For Southern Meet-  
ing—Cincinnati And Cleveland Lead  
In Competition For Coal Conven-  
tion And Exposition*

THE thirty-first annual convention of the American Mining Congress, which was held at the Mayflower Hotel, in Washington, D. C., from December 5 to 8, inclusive, was highly successful from every standpoint. The program covered a wide variety of excellent addresses on timely mining subjects. Views were advanced by Government officials, Congressmen, and mine operators, and the objectives sought in resolutions adopted by the convention dealt with the

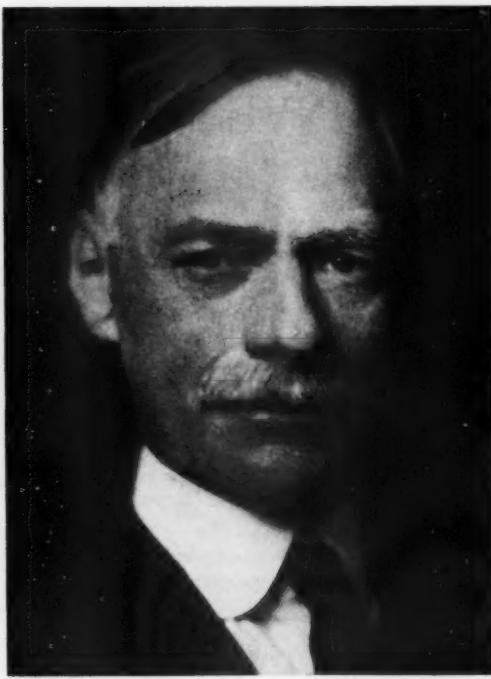
most outstanding mining issues of the day. The business sessions of the convention were interspersed with a number of delightful social occasions which afforded the visiting delegates an opportunity to become better acquainted with their associates in the mining industry and officials who enact and administer the laws of the land. An international touch was given

to the convention by the appearance on the speakers platform of a representative of the mining industry of Canada and at the banquet table of representatives of foreign countries.

Robert E. Tally, of Clarkdale, Ariz., general manager of the United Verde Copper Company and a leader in the mining industry of the West, was the choice of the delegates for the presidency of the American Mining Congress during the next year. Mr. Tally has long been



*The banquet at the annual convention of the American Mining Congress*



*Otis Mouser, newly elected director.  
Mr. Mouser is president of the Stonega  
Coke and Coal Company*



*S. L. Mather, newly elected director and  
third vice-president. Mr. Mather is presi-  
dent of the Cleveland Cliffs Iron Com-  
pany*

actively identified with the work of the organization, and during the past year has served as its first vice president. William H. Lindsey, of Nashville, Tenn., president of the Napier Iron Works, who was president of the American Mining Congress two years ago, was recalled to serve as first vice president. Former Governor Jesse F. McDonald, of Leadville, Colo., president of the Downtown Mines Corp., was chosen second vice president; and S. L. Mather, of Cleveland, vice president of the Cleveland Cliffs Iron Co., completes the list of officers as third vice president. J. F. Callbreath was reelected as secretary and was felicitated by the Board of Directors in the form of a special resolution drafted by a committee of its members in consideration of his long service as the executive secretary of the organization. J. B. Warriner, of Lansford, Pa., vice president of the Lehigh Coal and Navigation Company, and Otis Mouser, of Philadelphia, president of the Stonega Coke and Coal Company, were added to the board. Mr. Tally, Mr. Warriner, and Mr. Mouser will constitute the new Executive Committee. James T. Skelly, of the Hercules Powder Company, of Wilmington, Del., together with Mr. Tally, Mr. Mather, and Mr. Mouser, were elected directors for three years, beginning in 1929, and Mr. Lindsey a director two years, beginning in 1929.

#### MANUFACTURERS DIVISION

The Board of Governors of the Manufacturers Division referred to a committee the matter of selecting the time and place for the next annual convention of practical coal operating officials and exposition of mining machinery and equipment. In addition to Cincinnati, where the convention has been heretofore held, invitations were received from Cleveland, Chicago, Columbus, Philadelphia, Atlantic City, Pittsburgh, and West Baden Springs. The committee to select the convention site consists of H. A. Buzby, of the Keystone Lubricating Co., of Philadelphia, chairman of the Board of Governors; L. W. Shugg, of the General Electric Company of Schenectady; and J. F. Callbreath, secretary of the American Mining Congress. At a luncheon meeting of the board at the Metropolitan Club an address on the work of the Department of Commerce was made by Walter H. Rastall, chief of its Machinery Division. The board held its meeting December 4, at which it also revised its constitution. In the absence of President Buzby, the meeting was presided over by C. L. Herbster, of the Hockensmith Wheel and Mine Car Co., of Penn, Pa., vice chairman.

The convention opened at noon December 5, following the registration of delegates in the morning. The beginning of the convention was marked by a luncheon

tendered the delegates by the American Mining Congress, at which short talks were made by Secretary of Labor James J. Davis; A. G. Mackenzie, of Salt Lake City, Utah, secretary of the Utah Chapter of the American Mining Congress; H. N. Eavenson, consulting engineer, of Pittsburgh; S. S. Tuthill, of New York, secretary of the American Zinc Institute; G. Chester Brown, secretary of the California Metal and Mineral Producers Association; former Governor McDonald, of Colorado; and W. E. E. Koehler, secretary of the Pocahontas Coal Operators Association.

#### BRADLEY ADVISES COOPERATION

J. G. Bradley, of Dundon, W. Va., president of the American Mining Congress and also president of the Elk River Coal and Lumber Company, presided at the first business session the afternoon of December 5, delivering an address in which he recommended cooperation of the mining industry with Government agencies. Mr. Bradley was compelled to leave the convention after this session to attend the sickbed of a brother. Mr. Bradley praised the American Mining Congress for its varied activities and achievements.

This session of the convention was devoted to a consideration of the international mining situation, and the speakers included officials of the Government on foreign mining questions, and a represen-

tative of the Canadian mining industry. A most interesting address, supplemented by illustrated charts, was given by J. W. Furness, Chief of the Minerals Division of the Bureau of Foreign and Domestic Commerce of the Department of Commerce, on the flow of minerals in the world trade. He stated that New York has supplanted London as the center of the mineral industry of the world, but that if America is to maintain its position as a dominating factor in international trade in minerals, the mineral producers must keep in mind the balance existing between resources, rate of production, and expanding markets.

An invitation to American capital to participate in the development of Canadian mineral industries was extended by G. C. Bateman, of Toronto, secretary of the Ontario Mining Association. Mr. Bateman delivered an informing address on the present and future development of mining in Canada. Mining in the Argentine was discussed by H. Bentley Mackenzie, formerly American commercial attaché to Buenos Aires. "The Argentine Government offers every encouragement to the mining industry," said Mr. Mackenzie. "No taxes are levied on mines and minerals, and the discoverer has prior rights over all other applicants for mine properties. It is stipulated, however, that all mines must be worked by at least four men and for a period of 230 days in the year."

The growing importance of South Africa to American capital interested in investments in its mineral industry was outlined by Perry J. Stevenson, American trade commissioner to South Africa. "In recent years, American dollars have gone into Africa on an increasing scale in gold, diamonds, copper and chrome," he stated. "American industry must look to southern Africa and similar areas for new sources of supplies to meet the growing demand for raw materials to sustain our expanding industrial machine."

#### MINERAL TAXATION

Taxation of minerals was the subject of the morning session, December 6, presided over by former Governor McDonald. The session was also marked by an address by Secretary of Labor Davis on the danger of overcompetition in the mining industry. Mr. Davis said: "The mining industry is producing too much and the competition is disastrous. Unreasonable competition seems to have had a tendency to lower the standard of living, not only of the workers but those who have invested in mining. In the matter of coal it is a falsehood to say that competition is the life of trade. There has been altogether too much competition. The coal industry has been overstimulated." Secretary Davis declared that industries producing luxuries and semiluxuries are striving to cheapen

or break down the price of coal, which he deplored.

Foreign mining taxes and double taxation relief was discussed by Mitchell B. Carroll, Chief of the Section of Taxes and Corporations of the Division of Commercial Laws of the Department of Commerce. Mr. Carroll said the United States has been a pioneer in granting relief from double taxation. He gave an interesting review of the mine taxation



© C. O. Buckingham.

U. S. Treasury Building

The mirage effect is the result of a little rain on the ballustrade at the west entrance.

policies of England, Canada, France, Latin American countries, and Mexico, and also reviewed the work of American tax experts, including Prof. Thomas S. Adams, at recent international taxation conferences.

Messrs. McDonald, Mackenzie, and H. B. Fernald, tax authority of New York, were appointed a committee on nominations.

J. H. Wilson, of the Ohio Brass Company, of Mansfield, Ohio, and Messrs. McDonald and Brown were named to nominate the committee on resolutions. This committee was composed of one representative from each state, with Mr. Brown as chairman, as follows:

H. B. Hillhouse, for Alabama; Judge J. H. Hand, for Arkansas; G. Chester Brown, for California; J. F. McDonald, for Colorado; J. T. Skelly, for Delaware; J. M. Mallory, for Georgia; George B. Harrington, for Illinois; Willard Welsh, for Massachusetts; Dr. J. J. Rutledge, for Maryland; W. J. Jenkins, for Missouri; H. K. Porter, for New Jersey; Harry L. Day, for Idaho; H. B. Fernald, for New York; F. B. Richards, for Ohio; J. D. Conover, for Oklahoma; A. W. Strowger, for Oregon; Howard N. Eavenson, for Pennsylvania; Charles G. Whaley, for Tennessee; A. G. Mackenzie,

for Utah; C. E. Bockus, for Virginia; R. L. Lambie, for West Virginia; Sidney Norman, for Canada; and Ernest C. H. Roschen, for Panama.

E. C. Alvord, special assistant to the Secretary of the Treasury on tax matters, advocated avoidance of litigation in settlement of tax liability. He stated that neither the Government nor the taxpayers can afford litigation, and that the ideal way of adjusting tax cases is by administrative settlement, through closing agreements.

#### MINE DEPLETION

In a review of the work of the Treasury Department and congressional committees toward revision of the depletion section of the income tax law, McKinley W. Kriegh, Chief of the Tax Division of the American Mining Congress, stated that Congress in the near future will consider an amendment to the law providing for determination of depletion allowances for mines on the basis of a fixed percentage of income. In pleading for a fair and just Federal tax policy on mining, Mr. Kriegh declared that the mining industry "has been singled out for special forms of taxation and has been discriminated against by taxation authorities generally."

Elimination of taxation of capital gains and a flat rate applicable to all incomes was advocated by Mr. Fernald. He stated that there seems to be a real desire on the part of taxing authorities to deal fairly with the taxpayer as to the many complicated transactions arising in modern business.

#### SOUTHERN DIVISION

The Board of Governors of the Southern Division at a luncheon meeting selected Atlanta as the 1929 convention city for the Southern Industrial Development Conference, to be held in March or April. Mr. Lindsey, George H. Bailey and Dr. Henry Mace Payne, of the American Mining Congress, the latter secretary of the division; Judge J. H. Hand, of Yellville, Ark.; J. M. Mallory, of Savannah; and Bruce Tyler, of Johnson City, Tenn., were appointed committee to select the date. Judge Hand told the board that an available and adequate supply of hydroelectric power to meet industrial demands has had a stimulating effect upon the mining industry in Arkansas. Two large zinc companies are preparing to produce zinc ore in the Ozark district and to erect electrolytic smelting plants in connection with their mining operations. One of those companies will require 20,000 electrical horsepower to carry on mining and refining operations. It has acquired several proven zinc properties, some of which have been equipped with modern concentrating mills.

A new enterprise in the manganese industry has entered the White River dis-



Luncheon tendered to delegates on the opening day of the Convention

trict and is preparing to produce manganese pig, in conjunction with operation of iron mines which it owns, in southern Missouri, where a blast furnace is also being erected. The manganese ore will be transported to the furnace by auto trucks over a newly completed interstate highway.

Judge Hand stated that development of the marble and lime industries at Batesville and extensive pottery works, using the choice clay deposits at Benton and Camden, are the result of economic commercial power extensions that are being prosecuted in Arkansas.

An exhibit of black marble, clay products, snow-white chalk, zinc, lead, and other features of Arkansas mineral developments were shown by Judge Hand at the convention and afforded proof of that state's coming prestige in the mining and manufacturing industry.

A luncheon meeting was also held by the Committees on Underground Power Transmission and Power Equipment of the Metal Mining Branch of the National Standardization Division.

Ladies accompanying the delegates were entertained at luncheon at the Columbia Country Club by Mrs. John Howard Crocker, daughter of Mr. Callbreath.

#### COAL VIEWS

C. E. Bockus, of Dante, Va., president of the Clinchfield Coal Corporation, presided over the afternoon session December 6, which considered questions affecting the coal industry. A plea to restore the bituminous industry to the level of prosperity of other industries was made by H. E. Willard, of Cleveland, secretary of the United States Coal Co. He stated that labor conditions had been rearranged in West Virginia, Pennsylvania, and Ohio which would assure freedom from future strikes and lockouts. He urged that the

industry be given the same favorable consideration by the Government which had been extended to other industries.

Reorganization of the bituminous industry with distributing and sales agencies in the various producing districts was preferred to Government control and regulation of the industry by J. D. Francis, of New York, vice president of the Island Creek Coal Co. He attributed the present ills of the industry to the failure of railroads prior to 1923 to furnish adequate transportation and to frequent and long strikes. Selling agencies were recommended for the following coal districts: Central Pennsylvania, western Pennsylvania, Maryland and northern West Virginia, southern West Virginia and eastern Kentucky, Virginia and Tennessee, Alabama, Ohio, Indiana and western Kentucky, and Illinois.

A. B. Jessup, of Jeddoh, Pa., vice president and general manager of the Jeddoh Highland Coal Company, told the convention how anthracite is meeting competition, and B. Mifflin Hood, of Atlanta, president of the B. Mifflin Hood Brick Company, spoke of the future of nonmetallics.

A delightful dance was held in the Chinese Room of the hotel the evening of December 6.

#### MINE MECHANIZATION

Mechanization of mines featured the sessions of December 7. In the morning L. C. Madeira, of Madeira Hill & Company, of Philadelphia, presided, at which Dr. E. E. Lincoln, economist of the corporation, delivered an address prepared by Col. M. C. Rorty, vice president of the American Telephone & Telegraph Co., of New York, on mechanization as necessary in the development of human progress. With increasing mechanization, he said there will be no decrease in employ-

ment, but a shifting of workers from older occupations to production of new luxury and semiluxury goods. J. B. Pauley, chairman of the board of the Miami Coal Co., of Chicago, stated that mechanization would aid in solving the problem of overproduction.

Dr. L. E. Young, of Pittsburgh, vice president of the Pittsburgh Coal Co., conducted the first meeting of the National Committee on Mechanized Mining recently appointed to carry on a survey during the next five years looking to the increased use of machinery in the mining of coal. The meeting was attended by state chairmen and district representatives of practically every coal-producing field in 21 states. Dr. Young, as national chairman, outlined the plans of the committee, which he said would be of considerable value in stabilizing the coal industry and developing standards of mine practice and equipment.

Dr. Young challenged the coal-mining industry to make advancements through enlarged mechanization similar to those which had been produced in the iron and steel industry. Dr. Young stated that the object of the mechanization program launched by the American Mining Congress through this committee is to eliminate drudgery and to improve the standards of living in the coal industry.

Col. W. R. Roberts, chairman of the board of Roberts & Shaefer, of Chicago, presided over a group meeting, which considered standardization of mine practice and equipment. Matters pertaining to adequate ventilation of coal mines were considered at a meeting of the Ventilation Committee of the National Standardization Division.

Mr. Skelly presided over the Board of Directors at a luncheon meeting at which the new officers were chosen.

Metal mining was considered at the

afternoon session December 7, presided over by H. De Witt Smith, of New York, an official of the United Verde Copper Company.

#### STRATEGIC MINERALS

Assistant Secretary of War Charles B. Robbins told of plans of the War Department to assure adequate supplies of essential war materials in case of emergencies. These involve the stimulation of production of domestic resources, substitution of materials for those of which the country lacks adequate supplies, and storage in peace time of necessary supplies of strategic war materials.

C. F. Kelley, of New York, president of the Anaconda Copper Mining Company, advocated conservation of metals to prevent overproduction, similar to steps being taken in the oil industry under the Federal Oil Conservation Board. He recommended that the Government make a survey of the metal resources of the country and permit a constructive policy concerning their development and production.

Mr. Mather advocated removal of state and Federal tax inequalities in the iron ore mining industry. He discussed conditions in the industry in Minnesota, Michigan, and Wisconsin.

The annual banquet the evening of December 7 was a colorful social event and highly enjoyed. In his usual gracious manner, Mr. Lindsey presided, and former Representative P. P. Campbell, of Kansas, acted as toastmaster. Rev. James S. Montgomery, chaplain of the House of Representatives, offered the invocation. The diplomatic corps was represented at the speakers table by Señor Julian Encisco, charge d'affaires of the Argentine Embassy, and Dr. E. L. Baer, secretary of the German Embassy. The main speaker was former Senator A. O. Stanley, of Kentucky, who praised the achievements of mining engineers and opposed Government regulation of the coal industry as proposed in pending legislation in Congress. A delightful program of vocal and instrumental numbers was rendered by talent from the National Broadcasting Company, followed by dancing.

The concluding session, the morning of December 8, was presided over by Mr. Warriner, at which reorganization of the Budget Bureau with technical men to pass on mining and other scientific appropriations was recommended by Senator Tasker L. Oddie, of Nevada. Representative Scott Leavitt, of Montana, pointed out the relation of mining to the general prosperity of the country.

#### INDUSTRIAL STANDARDS

William J. Serrill, of Philadelphia, president of the American Standards Association, outlined the service to industry

through the development of standards by that association and its cooperating organizations. Mr. Serrill said the recently organized commercial standards unit in the Bureau of Standards of the Department of Commerce will not compete with commercial standards organizations. The bureau will submit standards developed by it for approval of these outside organizations and not conflict with their activities. "Standardization should be undertaken by industry under its own



A Washington Park

guidance," said Mr. Serrill. "Standardization tends to substitute machinery in place of hand labor in the interest of labor. It tends to increase the output of the workman and to maintain or increase a high wage rate."

The final business of the session was approval of the report of the Resolutions Committee, presented by Mr. Brown. The resolutions called for continued tariff protection to the mineral industries, revision of the national tax laws to relieve the mining industry of burdensome taxes, exemption from Federal tax of income from gold mines, creation by the American Mining Congress of a committee to develop geophysical prospecting, increased funds for mining investigations by Federal and state bureaus of mines and geological surveys, restoration to mineral entry of withdrawn public lands in national forests, and opposition to Government regulation of private business.

A number of mining and other societies were represented by delegates at the convention. These included the following:

American Institute of Mining and Metallurgical Engineers—Director George Otis Smith and H. I. Smith of the Geological Survey, and W. M. Corse of Washington, D. C. American Association of Petroleum Geologists—H. D. Miser, of the Geological Survey. American Engineering Council—F. L. Hesse, of

the Bureau of Mines, and J. M. Carmody, of Chicago. American Association for the Advancement of Science—Drs. G. R. Mansfield, C. R. Mendenhall, and David White, of the Geological Survey. American Mathematical Society—Dr. C. E. Van Ostrand, of the Geological Survey. American Institute of Accountants—H. B. Fernald, of New York. National Association of Certified Public Accountants—J. R. Hutchinson, chairman of the board, and J. O. Berkley, of Washington, D. C. National Lime Association—N. G. Hough and W. V. Brumbaugh, of Washington, D. C. Tri-State Zinc and Lead Ore Producers Association—J. F. Robinson, of the Commerce Mining and Royalty Company, of Miami, Okla. Colorado Metal Mining Association—J. O. A. Carper, of Cripple Creek, Colo. American Society of Mechanical Engineers—Prof. L. H. Crook, of Washington, D. C.

#### STATE DELEGATES

State delegates attended by appointment of their governors as follows:

By Governor Baker, of Missouri: State Geologist H. A. Buehler, of Rolla; Firmin Desloge, Jr., of the Desloge Lead Co., and J. A. Caselton, of the St. Louis Smelting and Refining Co., of St. Louis; L. T. Sicks, of the St. Joe Lead Company, of Bonne Terre, and the following from Joplin—George Potter, of the Eagle-Pitcher Lead Co.; Frank C. Wallower, of the Evans Wallower Lead Co.; C. T. Orr, of the Athletic Mining and Smelting Co.; P. B. Butler, of the Bransdall Zinc Co., and Victor Rakowsky.

By Governor Donahey, of Ohio: Ezra Van Horn, vice president of the Clarkson Coal Mining Company; W. L. Robinson, vice president of the Youghiogheny and Ohio Coal Company; R. L. Ireland, Jr., general manager of the M. A. Hanna & Company; and William Emery, Jr., president of the Cambridge Collieries Company, all of Cleveland; George M. Jones, president of the Ohio Collieries Company, of Toledo, and George K. Smith, chairman of the board of directors of the Sunday Creek Coal Company, of Columbus.

By Governor Parnell, of Arkansas: Mayor F. F. C. Woodward and Thomas Schell, J. P. Cargill, R. A. Dowdy and W. H. Seary, of Batesville; W. A. Dowell, of Walnut Ridge; C. F. Hyton, of Benton; Tracy Mills and Elbert L. Smith, of Pine Bluff; Mrs. V. L. Walton, of Yellville; L. L. Brown, of Zinc; W. P. Campbell and R. E. Truett, of St. Joe; C. F. Ballauf, of Mena; J. H. Roy, of Harrison; D. O. Roller, of Texarkana; D. D. Duncan, of Guion, and I. D. Hill, of Little Rock.

By Governor Ritchie, of Maryland: Dr. J. J. Rutledge, chief mine engineer, and Arthur B. (Continued on page 22)

# WHY *the* CLEARING HOUSE of MINING\*



*Position Of American Mining Congress As  
A Clearing House For The Problems Of  
All Of The Mineral Industries Firmly  
Established—Necessity For Such Cooper-  
ative Effort, Especially In Connection With  
Government Agencies Outlined—Present  
Political Situation Demands  
Cooperative Action*

By J. G. BRADLEY †

WHEN we of the American Mining Congress were preparing for this convention, we had, of course, a program committee. I could not attend any of its meetings, but my imagination tells me what went on. The members of that committee evidently decided that you members ought to be brought up to date on:

What the mining industry itself has done for itself;

What the Mining Congress has done for the mining industry; and

What the Mining Congress is—a psychoanalysis of it, so to speak.

Evidently these same gentlemen selected me as the psychoanalyst of the organization for this occasion. Unless I have missed my cue, they rely upon me to dissect the heart and mind and nerve energy of the American Mining Congress and to give you the result of my diagnosis. That would be interesting if it could be done. But it can't be done; they selected the wrong man to do it. I am no doctor. I am no scientist. Indeed, my generation was not scientific. We fathers are so far behind the times in scientific matters that we hardly know enough about such things to engage in conversation with our scientifically trained children. So the members of the committee picked on the wrong man to do the very simple job which those youngsters—and hence scientists—had in mind.

However, you will have to admit they did select a subject for me which proved conclusively that they, themselves, had done the psychoanalyzing and had arrived at a very definite conclusion. That is, they told me to talk about "the clearing house of mining." Of course, they let

me know that by that title they meant the American Mining Congress. It is the clearing house of mining. And it was in their minds that you members ought to be reminded that this is the clearing house of mining. It was obviously in their minds that I ought to inform you on that subject. Regardless of their hopes and plans, I am not going to do it—not, at least, for the full 20 minutes at my disposal. It is not necessary. I have served for a year as the president of the Mining Congress, and I know that it is the clearing house of mining. You have been members of the Mining Congress for many years. You know that it is the clearing house of mining. We all know it. So what is the use of exposing something which is common knowledge? The members of the program committee were clearly mistaken in assuming that we do not know it. They occupy the position of the gentleman who said that he could not see the forest for the trees. They are so close to the organization that they do not appreciate how much we all realize that this Congress is the clearing house of mining. When a subject is so thoroughly established, why talk about it?

But there is one phase of this same subject which is, I believe, worthy of protracted discussion; I even believe it worthy of very careful study. For that reason I am going to change the assigned subject ever so slightly; I am going to prefix just one little word of three letters:

"Why the clearing house of mining?"

That is, what reason or occasion or need is there for the maintenance of a clearing house of ideas or of encouragements or of alarms for the mining industry? What can the iron miner learn from the coal miner? What can the precious-metal miner learn from the miners of the baser metals? What possible disease can spring up in one branch



of the mining industry which may, or might, endanger another and almost unrelated branch of the same industry or even the whole of it? How can a clearing house check the distemper, spread the alarm, or supply the cure?

I have, as I have said, served a year as president of this Congress. I know, now, that a president is not expected to do much. I say this as a result of my own experience and as a word of advice to the gentleman who is about to succeed me. The primary duty of the president of the Mining Congress is to watch somebody else working. And I have done a good job in that respect, at least. I have occupied a grandstand seat directly behind the pitcher. I have seen many very fast plays; I have seen some very beautiful and effective teamwork between the staff and the committees of this Congress. And the spectacle at times has been thrilling. To mention one detail which comes home to me with peculiar force: I have seen the coal industry in danger of losing its economic liberty. And, from my seat in the grandstand, I knew that—to use baseball language—if the opposition had put that particular runner out they would have retired the side and might have ended the game for the whole team that has been pulling together in this Congress. That is, if the principle which was sought to be established in connection with bituminous coal had been actually established, I saw and knew that sooner or later every branch of the mining industry would have been subjected to the same kind of treatment for the same reason. I believe this simple illustration answers, in the main, the major question which I asked: Why the clearing house of the mining industry? I believe you will all see that there is a peculiar need for such a clearing house—somebody to warn you

\* Presented to the Thirty-first Annual Convention of The American Mining Congress, Washington, D. C.

† President, Elk River Coal & Lumber Company, Dunton, W. Va. President of The American Mining Congress.

that a movement which starts in coal may soon take root in gold; that something which starts in iron may easily find an expression soon in zinc. And to relate a movement back to the principle involved is the function of the Mining Congress.

But that is old stuff. We have all said it hundreds of times. We all know it, therefore; we have no need to be told what we already know and what each one of us thinks he, individually, originated. That, however, does not tell us why we should continue to maintain this clearing house. Certainly it does not tell us why, this year, we should have an especially effective clearing house. Indeed, some of us may feel that whereas we needed one in past, our dangers are over; that, in an era of safety, we might as well disband and dispose of the watchers on the towers of Zion. I know why you talk and think that way. In a sense, you may be justified. Just the same, I am exactly of the opposite opinion. I believe we need, now, the best organization we ever had; that we need, now, to be on the alert more than ever, and that we need the best watchman we ever had. I will state my reason briefly.

I do not need to remind any one of you that the White House is the most conspicuous mansion on earth. I do not need to remind you that this is so because ours is the richest and most powerful nation of all time. And I do not need to tell you—especially so soon after a quadrennial election—that men will do almost anything to have themselves chosen to occupy that conspicuous place.

In detail, we had, on several occasions in past, to rely on the skill of soldiers. After the fighting was over we selected the successful general as the man to occupy the White House. From that time until now we have never had to beg any man to take a generalship in our Army. And it is easy for us to imagine that every man who wears the star on his shoulder dreams at some time or another that, maybe, some day, the people, in gratitude may elect him as their President. Maybe that is why we can hire generals for \$10,000 a year when, with the same skill, they can make ten times as much in private life.

Incidentally, after the Civil War, we had to build a sound economic system which would encourage manufacturing. To do so we decided to protect certain of our industries, especially during their infancy. Because this worked out quite well we elected one outstanding author of our tariff laws to the presidency. After that men fought for the opportunity to write our tariff laws. They all thought that the lightning might strike twice in the same place. We got, as a consequence, more experts on fiscal policy than could have been developed by any

other possible method of propagandizing.

Most men would like to be President of the United States and are willing to do almost anything to get there. Thus, when they are told that one method lifted one man to that lofty position, they are prone to do exactly what he did in hope that the result will be the same. When the presidency is involved, we are an imitative people, you know. We are even more imitative, in our politics, than are the Japanese in mechanics.

We have just elected a most excellent man to the presidency. He did something entirely new in politics. He won our highest office because he had displayed wonderful efficiency in the conduct of a Federal department. That is a new way of reaching the presidency. Of course, others are going to follow it—if they can. Therefore, without knowing it, we have entered upon an era of department building—with the presidential trophy as the goal.

I want you to understand that I know Mr. Hoover and that I respect him most highly because I do know him. Before the nominating convention, I supported him in my own state of West Virginia. In the campaign I supported him. And at the polls I voted for him. I am for him now, because I know him through and through. Mr. Hoover is the kind of a man you can follow with your eyes shut. But, while that is true, any man would be a fool if he actually should follow Mr. Hoover—or any other man—with his eyes shut. I say that not because I have the least doubt about what Mr. Hoover is going to do. I know what he is going to do. He said publicly that he is against the general spread of bureaucracy. I believe him. I have no fear of him. Just the same, I am going to keep my eyes open so that I can watch the men who are following and who will try to mimic Mr. Hoover; who hope to elect themselves as his successors by building Federal departments. Because we have a saint at the head of a church procession does not mean that they are all saints who follow in his train. And Mr. Hoover's personal virtues will not atone for much that will be done in his name—without his knowledge and behind his back. Men did it to George Washington and Abraham Lincoln; they will do it to Herbert Hoover. We are not dealing with a man; we are dealing with human nature.

Many of you were ardent admirers of Mr. Roosevelt. You believed that he was a great and a good man. He had a way of preaching righteousness in business which, in general opinion, did more to clean house in American business than anything which had been done in a century. You believe that Mr. Roosevelt's preaching of morality put business ethics in America far and away above those of

the whole world. As you all remember, he had a marvelously vigorous way of saying what he thought. His teaching of morality was often concealed behind the most violent castigation of certain business practices. But Mr. Roosevelt had imitators. And have you realized what they have brought down upon this country? They were all earnest men. They all have used his violent method of expression. Especially, they all have employed his method of teaching by denunciation. But not one of his imitators so far has thought to bottom his preaching on personal or civic righteousness. As a result we, as a Nation, have been scourged with rattlesnakes—reptiles which make a noise and spread poison; which kill without doing any good.

When a great moral force like Mr. Roosevelt can be nullified by the misguided efforts of those who mimic him, I consider it extremely wise for us all to keep our eyes on the procession which will fall in behind the virtuous Mr. Hoover.

The one thing which, in particular, we will need to watch is the effort to build up Federal departments. Mr. Hoover became a great man among us because he took the small and neglected Department of Commerce and built it into a real organization. It was a splendid thing to do. But you and I know that unless the building was done exactly right it was a dangerous sort of thing to try. It was a blessing of providence that if that work had to be done, it was entrusted to the hands of Mr. Hoover. It was one of those things which might have turned out all right or it might have turned out all wrong. It happened to turn out all right, merely because Mr. Hoover was the right sort of a man. But given a man with the same skill and the same energy, but of a different soul, and we might today be facing a far different situation. Personally, I would rather see a Government department that was so innocuous that it was a joke than to have one which was vigorous and so essentially bad that it was a public menace. We have had experience of that sort in the past. We need, right now, to be on guard against other bad ones which may easily come along.

You gentlemen all know that, in a very few weeks, the city of Washington will be overrun by hopeful gentlemen who will be coming here to try to impress themselves upon the new government. Out of that host a few will be chosen for positions of responsibility. Some of them will be men of unbounded ambition. They will want to hoist themselves into great places. All of them will know that ours is a business country. They will want to impress themselves upon the Nation by means of what they cause the Government to do in (Continued on page 27)

THE TREASURY  
and INCOME TAX

(From page 9) before the Board of Tax Appeals, and the constant increase in the accumulation, had become alarming. The work of the Special Advisory Committee during the past year shows very substantial accomplishments. To handle cases involving questions of law or mixed questions of law and fact, the Review Division has been established in the office of the general counsel of the Bureau of Internal Revenue. Although this division has been functioning but three months, there is every evidence that it will be a real contributing factor toward removing the accumulation and a return to administrative settlement. Both agencies function informally, with across-the-table conferences, in a sincere effort to meet you in a give-and-take attitude and a desire to close your controversy in a businesslike manner. The result of these activities may be pictured briefly by the statement that for six consecutive months the number of cases disposed of by the board has exceeded the number of petitions filed, and the number of petitions is showing a marked reduction. From January 1 of this year to October 1, petitions decreased 20.9 percent and disposals increased 62.5 percent over the same months of 1927.

## CERTAINTY AND FINALITY

In order that neither of us may labor under illusions, let us agree that absolute certainty is impossible. So long as items of tax liability must depend upon the opinions of men, there will be differences of opinion, honest differences of opinion. An income tax law which is to apply fairly to our many different groups of taxpayers and our complicated business transactions, can not be simple. In fact provisions which appear simple frequently give the greatest difficulty. But sound administration can supply reasonable certainty.

Regulations interpreting the law are issued to guide the Treasury personnel and taxpayers, and rulings in specific cases are made and published. As a matter of sound policy, these interpretations should adopt a reasonable point of view. All doubtful questions should not be resolved against the taxpayer and in favor of the Government, nor should the other extreme be followed. Reasonable interpretative regulations will be supported by the courts and obviously will promote certainty. Even in those cases in which existing regulations are overruled in litigation, it will frequently be sound policy not to apply the necessary amendment retroactively. Personally I think we are approaching a time when the Government should absolutely assume the risk of interpreting the revenue laws. Until that time is reached,

we may in proper cases, under a new provision in the 1928 act, apply the amended regulations only to future cases. Furthermore, the regulations embody the best views of the department. They are promulgated by the Commissioner of Internal Revenue with the approval of the Secretary. They should be applied without question by every official and employee, and taxpayers who rely on them should be protected as far as possible.

Persons desiring finality in the determination of their tax liability may now enter into closing agreements. Such an agreement, except in the case of fraud or misrepresentations of a material fact, disposes of the case finally. It is binding upon all administrative officers, upon the Board of Tax Appeals, and upon the courts. The revenue act of 1928 amended the prior law so as materially to facilitate the entering into of closing agreements, and more than 500 are now being approved every day, with the average constantly increasing. Normally, a closing agreement will be entered into only after your case is finally audited and ready to be closed. In proper cases, however, you may now obtain a closing agreement upon particular issues, so that as the audit of your case proceeds the decisions reached upon these issues will not be upset. A request for closing does not result in a reexamination of your case and you need have no fear that it will be looked upon with suspicion. A closing agreement gives you certainty and finality. It fixes absolutely your tax liability and permits you to invest your funds or shape your business plans without fear of a demand for additional taxes. It guards you and the Treasury against changes in interpretation, whether administrative or judicial. It affords to both a deserving, and possibly a necessary, protection.

Your interests and the interests of the Treasury demand both certainty and finality. Neither can be brought about by resort to litigation. Both can be accomplished through administrative settlement.

## MINIMUM OF INCONVENIENCE AND OF EXPENSE

The real problem in the administration of an income tax is one of personnel. The Treasury is making every effort to retain and build up an efficient, courteous staff, familiar with the law and the regulations and appreciative of your problems and points of view. The decentralization policy has made these representatives reasonably accessible to you.

An administrative settlement will save time, avoid interruptions to your business, and reduce the expenses of attorneys, accountants, and engineers to a minimum.

## SETTLEMENT AS DISTINGUISHED FROM COMPROMISE

As I have stated upon other occasions, there is a very clear, well-defined distinction between the settlement of tax cases and the compromise of tax liabilities. I am not discussing a compromise of an admitted tax liability by the acceptance of the payment of a smaller amount such as is justifiable in cases of insolvency. A tax liability having finally been determined must be paid in full. The Treasury must and will exert every effort to collect the amounts properly due. The policy of administrative settlement, on the other hand, is applicable only in determining the amount actually due. It recognizes the necessity of ascertaining facts, the necessity of the application of common sense and sound judgment, and the existence of doubtful issues of relative unimportance as precedents, with a willingness to make mutual concessions. The Treasury is in effect a trustee for all taxpayers. It is subject to restrictions and limitations not applicable to private individuals. Tax cases may be settled only in accordance with the law and the regulations.

## ADVANTAGES OF ADMINISTRATIVE SETTLEMENT

The advantages to taxpayers and the Government resulting from the administrative settlement of tax cases may be summarized briefly as follows:

(1) You obtain a prompt determination of your tax liability, and the Government avoids the losses always accompanying delays and intervening inability to pay.

(2) You may obtain certainty and finality, relieving you of all liability for the payment of additional taxes and permitting you the free use of your funds, and the Government reduces its liability to refunds and is relieved of constant demands for reopenings.

(3) You avoid irritating interruptions in your business activities and are spared the severe costs of litigation, and the Treasury gains by concentrating on those cases which remain in litigation.

(4) Both gain the benefits of uniform interpretations and practices over a long period of time.

## CONCLUSION

Unless my analysis is faulty indeed, the interests of the Treasury and of the taxpayers in the administration of an income tax are almost identical. Neither can afford litigation. Neither want litigation. Both gain substantially from administrative settlement, and the gains are about equally divided except for one item not heretofore mentioned. There is a gain to the Treasury far exceeding the aggregate of all others, in the acquisition of that invaluable asset, the good will of its taxpayers.

# The FLOW of MINERALS into WORLD TRADE\*

By J. W. FURNESS †



*In 1926 Eight Countries Required More Than 80% Of The World's Production Of Twenty-Nine Of The Principal Minerals Of Commerce To Maintain Their Industries, Constituting More Than 70% Of Gross Value Of Mineral Raw Materials Entering World Trade—Balance Existing Between Resources, Rate Of Production And Expanding Markets, Three Major Factors In Maintaining Our Present Position*

STUDENTS of the earth's chemistry have demonstrated that the minerals upon which present industrial civilization is based are distributed widely and abundantly. From the point of view of utilization by man, however, the occurrence of a single mineral, or a group of minerals in sufficient size and concentration to make them commercially exploitable are relatively few and unequally distributed throughout the world. The ruling factor which determines the available quantity of any mineral is the cost of its production. Aluminum may be cited as an example. Minerals containing this metal are among the most widely distributed of any, but at present only those relatively few deposits containing bauxite may be considered as commercial sources.

The limitations of the sources upon which the industrial world has largely depended during the past five years may be illustrated in part by the following examples: The United States, United Kingdom, France and Germany produce more than three-fourths of the world's output of coal. The United States, Mexico, Russia, Persia and Venezuela produce 90 percent of the world's output of petroleum. Three economic centers, United States, Lorraine, United Kingdom produce 85 percent of the world's output of iron ore. Copper is furnished from three major sources; tin from three; nickel from two, etc.

The conclusion to be drawn from such facts as these is that the great sources of mineral supply are too few and irregularly distributed to give each nation its desired quota. Some nations have more than their share of the great mineral reserves of some minerals. Some na-



tions conspicuously lack reserves; no nation has a well-balanced supply of all minerals. It follows from this that nations are interdependent in regard to mineral supply and that international movement in trade in minerals is an inevitable consequence. There is a mineral trade balance between countries which can be changed only in minor ways by any effort of man. An understanding of this balance is essential to any interpretation of the broad economic relations. It is obvious also that the mineral trade balance based on unequal geographic distribution carries with it abundant sources of international friction. An understanding of the facts is the first-step toward meeting problems in this vital field of international relations.

The United States is the world's largest consumer of mineral raw materials, and in many cases is the largest producer of many of the minerals. For certain minerals, it is largely, and for others in specific cases, entirely dependent upon foreign sources to meet its requirements. As an importer, the United States is a vital factor in the world's market; indeed the world trade in minerals is largely influenced by the pros-

perity of this country. The United States, notwithstanding its large contribution to the world's production, produces few minerals which are exported in quantities sufficient to affect the world's market appreciably.

In order to form some idea as to the relative part played in international trade by the major industrial countries of the world, the chart to be thrown upon the screen shows the production in 1926 of eight countries which require to maintain their industry more than 80 percent of the world's production of 29 of the principal minerals of commerce, which constitute more than 70 percent of the gross value of the mineral raw materials entering world's trade.

YOUR attention is invited to the percentages shown under the United States. In the next chart to be shown, the same countries appear, and the consumption by these countries of 14 of the major minerals of commerce is given, thus indicating the position of the countries as to import and export trade. The United States produces, in round numbers, 60 percent of the total copper produced in the world, and requires 50 percent to meet its domestic demand, indicating a 10 percent exportable surplus. The United States produces 42 percent of the world's total production of lead and consumes 45 percent. In zinc the United States produces 45 percent of the world's total production and consumes 43 percent. In crude petroleum the United States produced 71 percent of the world's total production and requires 78 percent.

Parenthetically it should be remarked that while the United States consumes more crude petroleum than it produces, nevertheless it is the world's largest exporter of petroleum and its products.

## PER CAPITA CONSUMPTION

It has been estimated that the population of the United States is approximately one-seventh of the world's total.

\* Presented to the Thirty-first Annual Convention of The American Mining Congress, Washington, D. C.

† Chief of the Minerals Division, Bureau of Foreign and Domestic Commerce, Department of Commerce.

<sup>2</sup> Less than 1 per cent.

- 1 Less than 1 per cent.
- 2 No production recorded.

\* Total world production not reported.

5 Large production of synthetic nitrates

• Available statistics on nickel are too incomplete to warrant comparison.

In order to meet the requirements of the people of this Nation more than 50 percent of the world's total production of minerals is required. In 1924 the per capita consumption of coal in long tons in the United States was 4.4; Belgium, 4.17; United Kingdom, 3.85; France, 1.89; Germany, 1.69; Japan, 0.42 (estimated); Italy, 0.27; and Russia, 0.10.

Liebig, the great German chemist, one

But to return to the serious; the standard of living and the rapidity of economic development are directly related to the per capital consumption of minerals. The dearth in the per capita consumption of minerals in several of the countries cited indicates a possibility for expansion in consumption throughout the world.

responding period the rate of increase in copper has been approximately the same.

In 1857, the first year of any record of petroleum, production from a worldwide standpoint was made in Rumania, and consisted of 1,977 barrels. In 1858 Rumania's production was 3,560 barrels and in 1859, 4,349 barrels. In that year, 1859, the United States became a producer, with an output of 2,000 barrels. In the first three years the total world's production of crude petroleum was 11,886 barrels. In 1927 the United States produced 901,129,000 barrels, and the total world's production was 1,249,395,000 barrels.

In 1865 the world's production of coal was 182,000,000 short tons, of which the United States produced 13.6 percent and the United Kingdom 54.9 percent. In 1927 the world's total production of coal was 1,475,000,000 short tons, of which the United States produced 40.5 percent and exported 1.83 percent. The exports for this year were greater than the total domestic production made in 1865. In 1927 the United Kingdom produced 19.5 percent of the world's production and ex-

PER CAPITA CONSUMPTION OF COPPER, LEAD AND ZINC, IN POUNDS

Country	Copper		Lead		Zinc	
	1922-24	1926	1922-24	1926	1922-24	1926
United States	12.19	12.3	10.55	12.5	7.99	8.7
United Kingdom	4.54	5.23	9.02	11.2	6.63	7.1
Germany	4.41	5.4	3.34	5.5	2.51	4.57
France	6.26	6.1	5.36	4.8	5.12	5.26
Italy	1.46	*	1.57	2.18	0.59	5.04
Japan	3.62	2.57	1.10	1.9	1.56	*

\* Data not available.

time said something to the effect that the civilization of a country could be measured by the amount of soap it used. That measure is obsolete. Using the same epigrammatic form one might say that the civilization of a country can be measured by its per capita consumption of minerals. This comparison is most flattering to the United States.

Since 1907 the mineral production of the world has been greater than the entire production prior to that date. During the past 25 years the successive annual increase in the world's mineral production has been large. During the past 10 years the world's consumption of petroleum has increased at the rate of approximately 8.75 percent per year. For a cor-

	Aluminum	Antimony	Chromite	Copper	Iron	Lead	Manganese-ore	Mercury	Nickel	Tin	Tungsten-concentrates	Zinc	Coal	Petroleum
United States	A 60	A 42	A 65	A 50	A 52	A 45	A 22	A 30	A 38	A 53	-2)	A 43	A 38	A 78
Germany	B 11	C 5	C 7	B 12	B 13	C 14	E 6	B 20	C 4	-2)	(2)	C 12	B 20	E (3)
France	C 10	B 5	(2)	D 9	C 10	D 6	B 17	E 5	B 6	C 7	(2)	D 9	D .5	D (3)
United Kingdom	D 8	(2)	B 7	C 11	D 8	B 16	C 10	C 14	(2)	B 13	(2)	B 15	C 15	B 1
Japan	E 3	D 5	(2)	E 5	F 2	F 4	F 3	D 8	D 1	D 3	(2)	F 5	E 3	C (3)
Belgium	(3)	(2)	(2)	G 2	E 5	E 5	D 8	G 2	-2)	(2)	(2)	E 8	F 2	G (3)
Italy	F 2	E 1	(2)	F 5	G 1	G 3	G 2	F 4	(2)	E 3	(2)	G 2	G 1	F (3)
Spain	(3)	(3)	(2)	(3)	(3)	H 2	H (3)	H (3)	(3)	F 1	(3)	H (3)	H (3)	H (3)

\* Consumption not indicated.  
+ Less than 1 per cent.

<sup>a</sup> Less than 1 per cent.

ported 5.4 percent. As compared with the production made by the United Kingdom in 1865, the 1927 production of this country was approximately three times as great.

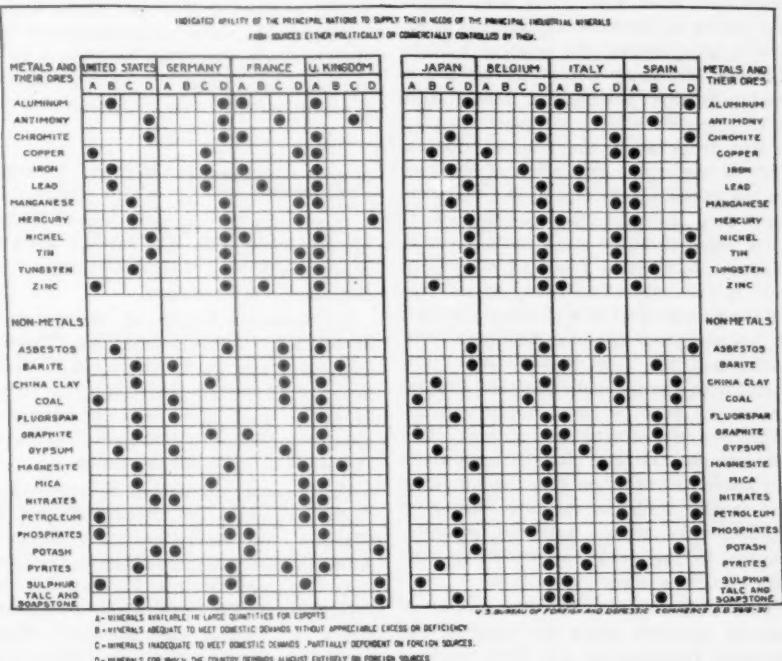
By the application of the advancements made in the science of technology the United States today refines large quantities of petroleum from foreign sources together with metals such as copper, lead and zinc from ores of foreign origin. This is in direct opposition to the situation which obtained in the early fifties. Shortly after the middle of the last century some of the ores produced in our western country were shipped to the Gulf of Lower California and exported to England and Continental Europe for smelting and refining. In the latter part of the century a part of the output of the complex zinc-lead ores of the Leadville district, Colorado, were shipped to Holland to be refined.

For a good many years the refiners of the copper industry were, broadly speaking, located on the Atlantic seaboard. During the past few years, however, there has been an ever-increasing tendency for the refineries to move nearer to centers of production in order to reduce the freight charges, due to the transportation, on unrefined products. Advances in technology, for example, the electrolytic reduction of zinc ores, concentration by flotation, as well as improvements in smelting, etc., have played an important part in this regard, especially when applied at or near the mines. A growing tendency is manifest on the part of the industry to partially fabricate mineral materials nearer the points of production than has been the custom in the past. Petroleum, a possible exception, is being transported to the seaboard and centers of consumption for refining. This, in part, is probably due to cheap transportation accomplished by pipe lines and tankers and the fact that

crude petroleum is used in some form to almost its entirety.

The chart appearing below indicates the ability of the principal nations to sup-

If the resources of mineral raw materials of the English-speaking nations were combined, they would form what might be termed an economic unit and



ply their needs of the principal industrial minerals from sources either politically or commercially controlled by them. This chart also indicates the countries having exportable surplus of minerals, the minerals in which they are deficient, for whatsoever reason, and the interdependence of these nations indicated through the mineral raw material requirements. The minerals occupying column "D" might be termed the strategic minerals of these industrial nations.

Your attention is invited to a position indicated by the United Kingdom (British Empire) and the United States.

would be to all intents and purposes self-sustaining.

The apparent position of the United States in its dependence upon foreign sources for a large part of its mineral requirements is, in many cases, a matter of commercial expediency, rather than the actual lack of the resource. As the larger part of the population of the United States inhabits the vicinity of the Atlantic seaboard, of a necessity this constitutes the consuming centers. Minerals domestically produced are, as a rule, geographically situated relatively distant from points of consumption and meet in

competition on the Atlantic seaboard with materials produced in foreign countries. It is a rather interesting fact that New York State is one of the large producers of gypsum, yet gypsum produced in Canada, due to water transportation, meets in New York City and successfully competes with material produced in this state. The imports of lead and iron ore are further examples of this point. The question of costly railway transportation of domestic minerals versus cheap water transportation of foreign minerals is an old one, and is mentioned only to call your attention to the possibility that due to the rapid advances being made by members of your organization along the lines of improved beneficiation and by concentrating before shipping the mineral raw materials, many of the minerals now imported may in a short time be eliminated by the capture of domestic markets by producers from within the country.

Since the World War, I think it can be stated without any great fear of contradiction that New York has become the center of the mineral industry of the world, supplanting the position held by London for many years. If we are to maintain this position, it would seem that ceaseless efforts be spent upon research work along the lines of elimination of waste and expansion of markets. In the mineral commerce of the world not only does one producing nation have to meet competition of other nations but in the specific mineral itself keen competition is encountered in many of its uses by the substitution of a cheaper material. A knowledge of the manifold uses of a metal and the close association of one metal with another indicates that at price one metal may be commercially advantageously substituted for another. As an example, artificial cinnabar, known to the trade as vermillion red, finds a large use in the trade as coloring matter in rubber. At price, artificial stibnite, known to the trade as antimony sulphurete, is a direct substitute.

One of the rather startling results of careful research along the lines of increasing consumption has been the results accomplished by one of our nickel companies. After 1922, due to the curtailment in the demand for armor plate, approximately 40 percent of the consumption of nickel was eliminated. The research work of the past six years has resulted in increasing the consumption of nickel to a point greater than at any time in the history of this metal.

In outlining some of the factors entering the flow of mineral raw materials in international commerce, may I emphasize three points which I have touched on, if at all, but lightly?

It would seem, if the United States maintains its position as a dominating

factor in the international trade of mineral raw materials, that the mining fraternity as producers must keep constantly in mind the balance existing between resources, the rate of production, and the expanding market for these various mineral raw materials, thus bringing into the picture three sources from which, in part, information may be obtained; namely, the United States Geological Survey, the Bureau of Mines, and the Bureau of Foreign and Domestic Commerce, in conjunction with the Bureau of Standards.

Before closing I would like to call your attention to the value of the imports and exports of mineral raw materials in the United States, United Kingdom, France, and Germany in 1927:

Country	Imports	Exports
United States.....	\$358,000,000	\$325,000,000
United Kingdom.....	348,000,000	348,000,000
France .....	358,000,000	194,000,000
Germany .....	322,000,000	281,000,000

The imports of these four countries in 1927 amounted to \$1,386,000,000; the exports, \$1,058,000,000. As these figures represent the value of unfabricated materials, some idea may be gained as to the monetary value of the international trade in mineral raw materials.

**MINING CONGRESS CONVENTION** || Stewart, president of the Davis Coal

*(From page 15)* || and Coke Company, of Baltimore; W. C. Snyder, general superintendent of the Consolidation Coal Company, of Frostburg.

By Governor Balzar, of Nevada: Senators Tasker L. Oddie and Key Pittman; Representative S. S. Arentz; J. F. Kennear, of Ely; Henry C. Rives, of Reno; Mark A. Bradshaw, Fred A. Cole, and Letson A. Balliet, of Tonopah; and Noble H. Getchell, of Battle Mountain.

By Governor Fisher, of Pennsylvania: State Secretary of Mines Walter H. Glasgow, of Harrisburg; William L. Affelder, vice president Hillman Coal and Coke Company; Thomas W. Dawson, vice president H. C. Frick Coke Company; Dr. L. E. Young, vice president Pittsburgh Coal Company, of Pittsburgh; D. D. Dodge, general superintendent W. J. Rainey, Inc., of Uniontown; J. B. Warriner, vice president Lehigh Coal and Navigation Co., of Lansford; A. B. Kelley, general manager, Humphrey Coal and Coke Company, and H. F. Bovard, president Keystone Coal and Coke Company, of Greensburg; Donald Markle, president, Jeddo-Highland Coal Company, of Jeddo; G. B. Hadesty, general manager, Philadelphia and Reading Coal and Iron Company, of Pottsville; Edward Griffith, general manager, Lehigh and Wilkes-Barre Coke Company, and Robert Quin, vice president, Susquehanna Collieries Company, of Wilkes-

Barre; A. J. Musser, vice president, Clearfield Bituminous Coal Corporation, of Indiana; and C. J. Golden, of Miners Union No. 9, of Shamokin.

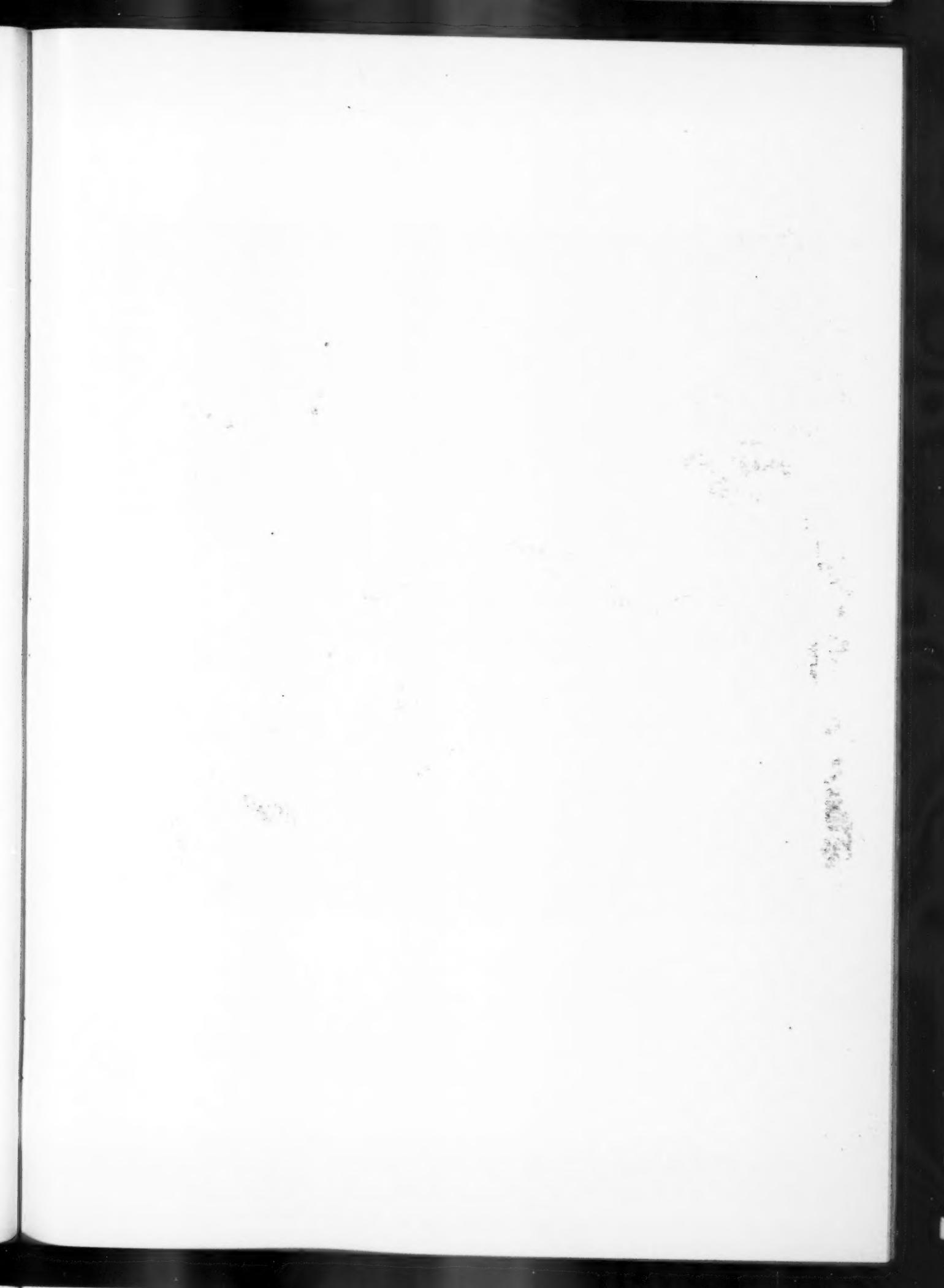
By Governor Byrd, of Virginia: Bruce P. Tyler, Clinchfield Coal Corporation, Bristol; Dr. Wilbur A. Nelson, professor of geology, University of Virginia; G. E. Smith, general manager, Wise Coal and Coke Company, of Dorchester; T. Gilbert Wood, N. & W. Railroad, and John H. Parrott, of Roanoke; M. J. Caples, vice president, Seaboard Air Line Railway Company, of Norfolk; R. E. Taggart, vice president and general manager, Stonega Coke & Coal Co., Big Stone Gap; Credo Kelly, and H. E. Gibson, of St. Charles; R. J. Holden, Virginia Polytechnic Institute, of Blacksburg; Barnes Gillespie and George W. St. Clair, of Tazewell; James E. Jones, of Pocahontas; Joel Asberry, of Parrott; D. R. Jones, Merrimac Anthracite Coal Corporation, of Merrimac Mines; Lee Long, Clinchfield Coal Corporation, of Dante; W. R. J. Zimmerman, of McCoy; James H. McNamara, of Eagle Rock; and H. C. McCormac, of Winchester, all of Virginia; E. C. Seares, of the Great Valley Anthracite Corporation, of Chicago; Charles E. Bockus, Clinchfield Coal Corporation, of New York.

By Governor Adams, of Colorado: John T. Joyce, commissioner of mines; James Dalrymple, state coal mine inspector; John T. Barrett; Fred Farrar; Charles Boettcher; Tyson S. Dines, president of the Chamber of Commerce; and C. Lorimer Colburn, secretary of the Metal Mining Association, all of Denver; J. O. A. Carper, of Cripple Creek; R. M. Henderson, manager of the Wellington mines, of Breckenridge; J. J. Shaw, manager of the Sunnyside Mine, of Eureka; W. E. Renshaw, manager of the Gem Mine, of Idaho Springs; Harry F. Bowen, of Canon City; F. J. Helwig, of Pueblo and former Governor Jesse F. McDonald, of Leadville.

The following are among some of the recently issued reports of the Bureau of Mines, copies of which are available:

*Ferrous Oxide from Iron and Magnetite*—By C. Travis Anderson. (Discusses results of experimental procedure in preparation of ferrous oxide from iron and magnetite; gives information on stability and behavior of this material.)

*Determination of Flakiness of Ores*—By Will H. Cowgill, O. W. Holmes, and A. B. Campbell. (Outlines method which may be used by zinc operators to determine flakiness of mill feed. Applies especially to Missouri-Kansas-Oklahoma district, where flakiness of mill feed has been blamed for losses of zinc.)





©Ernest L. Crandall

*The season's greetings with wishes for a  
New Year of national prosperity*

## A MINING SCHOOL *of* DISTINCTION\*



By NOEL HUBBARD †

THE School of Mines and Metallurgy of the University of Missouri was established by the Missouri legislature in 1870, and opened for instruction in 1871. In 1874 the first class was graduated. This consisted of John W. Pack, John Holt Gill, and Gustavus A. Duncan. Messrs. Pack and Duncan are still living, the former at Berkeley, Calif., where for a number of years he was head of the assay department of the San Francisco mint, and the latter at Pasadena, Calif., where he is a mine operator.

For nearly 60 years the school has been an important factor in the mineral industry. It has maintained a steady growth, with an enrollment for the present school year of 496 students.

The School of Mines and Metallurgy of the University of Missouri is the oldest independent mining school in the United States. At the time of its establishment two or three other mining schools had been established in conjunction with universities, but the School of Mines and Metallurgy was the first to be entirely separated from the campus of other schools. The University of Missouri proper is situated at Columbia, Mo. The School of Mines and Metallurgy was placed at Rolla, in the Missouri Ozark Mountains, as at that time, with the iron mining and smelting operations at Mermac Springs and other places in Phelps and adjoining counties, it was thought that the mining operations of the state were likely to center around this point. The great lead fields of southeast Missouri were but little appreciated then, and zinc had just been discovered in the Joplin district. Coal mining was of but little consequence in the state, and the ceramic industry, which is today one of the leading industries of the state, was unknown.

With the increasing complexities of the mineral industries the School of Mines and Metallurgy has become more and more a school of technology for such industries. Today it offers courses leading to degrees in 13 different branches, metal mine engineering, coal mine engineering, mining geology, petroleum engineering, civil engineering, metallurgy, mechanical engineering, electrical engineering, chemical engineering, petroleum refining, ceramic engineering, ceramic



Dr. C. H. Fulton, Dean

technology, and general science. The graduates from those courses not directly related to mining very largely go into the mineral industry. The increasing use of machinery in mining has led to demands for mechanical and electrical engineers. There is an increasing demand for such engineers from petroleum refineries for their experimental and operating work. There is also an increasing demand for civil and electrical engineers for geophysical prospecting, and many of the large oil companies are coming to this school for men trained in these fields. Advanced work in physics is offered for students interested in this type of work. Pipe-line work, construction work, and topographic surveying also take civil engineers trained in an atmosphere closely related to the mineral industry. All civil engineers are required to take work in the mining department in blasting and tunneling as a part of the work required for their degree.

Eight years ago this fall the School of Mines and Metallurgy entered a new administrative period under Dr. C. H. Fulton as director. During this administration there have been developed new

*School Of Mines and Metallurgy Of University Of Missouri, Established In 1871, Has For More Than Half Century Been Important Factor In The Mineral Industry, Giving To It Some Of Its Distinguished Members—Its Record, Its Plans For The Future, And Its Present Activities Outlined*



\* The first of a series of twelve articles on as many of the leading mining schools of America.

† Alumni Recorder, School of Mines and Metallurgy, University of Missouri, Rolla, Mo.

educational policies for the institution, and many changes and improvements have been brought about, some of a major character.

The educational policy of the School of Mines under the present administration has been to develop the school into such an educational institution as will best serve the interests of the mineral industry, and those intimately associated with it. The policy is also to thoroughly ground all students in the fundamental sciences, and to provide more and better opportunities for the especially gifted students. More opportunity has also been made available for students who desire to take, along with and in addition to their regular technical subjects, a certain amount of the so-called "humanistic" subjects. Records of the registrar show that approximately 90 percent of all graduating students have to their credit more than the required number of hours for graduation, and that this excess varies from 3 percent to as high as 20 percent. Many of these elective courses are taken in classes that meet at 7 o'clock of a morning, or after 4 or 7 in the evening.

The policy of providing courses of the "humanistic" type is clearly shown in the establishment, during and since 1920, of the departments of economics and biology, in which latter department have been organized courses in psychology, history, and sociology, together with those in biology proper. In the department of economics there are courses in labor problems and business organization, in addition to the regular two-term courses in economic theory. These courses in economics and business have not been expanded perhaps to the degree some men in the industry feel they should be. But such men should bear in mind the fact that the curricula of the School of Mines and Metallurgy now have the highest hour requirement for graduation of any school in Missouri, and any additional subjects would have to be at the expense of subjects already in the curricula. While the faculty realizes the great value of business training, it feels its primary function is the training of its students in engineering, and that this should not be slighted for other work.

In general, the type of engineering education aimed at is one that is not only good engineering education but good general education as well. All undergraduate engineering curricula have been

thoroughly revised within the last eight years, and as now constituted they are all very close to the standards recently recommended by the Society for the Promotion of Engineering Education, upon completion of its three-year nation-wide study of engineering education. The number of credit hours required are 150,

the school sent out on its own initiative. Information was solicited concerning the pre-college preparation and purposes of the graduate, the character of the work in which their fathers were engaged, the education of their parents, the subjects that the students liked and disliked, both in high school and in college. The

*Class work is carried on underground at the experimental School Mine, Missouri School of Mines. Left and right, surveying, and, center, hoisting rock*



plus military and physical education credits.

About four years ago the Society for the Promotion of Engineering Education made an exhaustive investigation of engineering education in America, cooperating with the 153 colleges of engineering in the United States and Canada.

The School of Mines and Metallurgy was keenly alive to all phases of the investigation. When the board of investigation had been set up by the society in the fall of 1924, and after it had invited the colleges of the country to appoint for each a cooperative faculty committee, Birector Fulton appointed a faculty committee for this school, with Prof. C. V. Mann, head of the department of engineering drawing, as chairman, and Prof. Mann was an untiring worker in all phases of the investigation at the School of Mines.

This committee held, the first year, 15 open meetings for faculty discussion of live questions on engineering education in all its ramifications. Several very prominent men from out of town visited the school and spoke to the faculty under the auspices of the committee. Among them were Messrs. Philip N. Moore and Arthur Thatcher, of St. Louis; Dean C. E. Seashore, of Iowa State University, a member of the board of investigation; H. P. Hammond, associate director of investigations; and Dean Milo S. Ketchum, head of the College of Engineering of the University of Illinois. Stenographic reports were made of all these meetings, and many most helpful suggestions and criticisms were thus preserved for the use of the committee.

Also the first year the committee sent out to all graduates of the School of Mines several questionnaires, in direct cooperation with the National Board of Investigation. Two such questionnaires

opinions of graduates concerning balance of the various courses and curricula in the school, and as to the objective towards which the school should direct its efforts in training men were requested. Questionnaires were given to each of the four classes in school the spring of 1925, seeking to obtain light on every phase of school activity. All this material was collected and tabulated in an orderly report of three volumes.

At the conclusion of the investigation the local committee on engineering education endeavored to select and recommend for adoption by the faculty those features of the new program that seemed worthy of a place in the program of the School of Mines. Among other things, a program looking toward a better opportunity for the superior group of students was adopted by the faculty, as was also a system of personnel records for students, and the Iowa placement test for freshmen, designed to single out both the superior and inferior student on the first day of school, so that by intelligent sectioning there might be formed for more efficient instruction groups that are superior, average, and inferior.

The school was an outstanding contributor of data to the three-year national investigation, and its work gained national recognition by the board of investigation. The school's courses and curricula in general are closely in accord with most of the recommendations made.

All courses are arranged to contain the necessary fundamental sciences and the essential technical subjects in such an order as to lead to a logical and coherent engineering education. The courses as outlined for the degree of bachelor of science in mine engineering have been divided into four groups—metal mining, coal mining, mining geology, and petroleum engineering.

It has been the aim in designing all of these mining curricula to avoid specialization as much as possible. The mining geology curriculum must of necessity include a considerable number of specialized geological courses. The other three, however, devote less than 10 percent of the total time to strictly specialized engineering subjects. They are in fact broad scientific courses that serve to give the student a fundamental scientific training rather than a specific training for some particular branch of the industry. This Prof. C. R. Forbes, head of the mining department, feels will better equip the graduates to handle the many varied problems that the mining engineer must undertake.

In order to provide a laboratory where practical instruction in mining and mine surveying can be given, the school has equipped an experimental mine. The entire plant has all the elements of a mine and gives the student a much better opportunity to grasp the problems of mining while studying them in the classroom than would otherwise be possible. The mine is located about 1½ miles from the school at the side of an old dolomite quarry. The main tunnel is about 200 ft. in length, 50 ft. of which is timbered. Branch drifts have been run from each side of the tunnel, making a total of over 600 ft. of underground openings. A small shaft 25 ft. deep connects the main tunnel with the surface. A Joplin type of hoist, located in the headframe over the shaft, is used to hoist the rock to the surface where it is dumped into a small ore pocket. From the ore pocket the rock runs by gravity to a Blake crusher, where it is crushed to 2 in. or smaller. From the crusher the rock runs to a belt-bucket elevator which discharges into a ¾-in. trommel on top of an ore bin. This bin is of 100 tons capacity and is divided

*More views showing class and laboratory work. Left, students drilling; center, experimental oil still in the Industrial Chemical Laboratory and, left, classifier in Ore Dressing Department*



members of the instructional staff of the School of Mines occupy official positions with these surveys. There are frequently opportunities for advanced students to get positions with one of these organizations to obtain experience during summer months. Most of the students at the present time who are doing graduate re-



experimental investigation in the metallurgical treatment of various ores. The ore sample room is well stocked, containing about 1,000 samples, all carefully prepared and assayed. The samples are characteristic ores and metallurgical products, such as matte, bullions, cyanide solutions, fumes, etc.



into two parts, one for coarse and one for fine material.

The power plant at the mine consists of a 125-hp. return tubular boiler, an Imperial type 10 Rand air compressor of 100 cu. ft. capacity, a Laidlaw-Dunn-Gordon air compressor of 150 cu. ft. capacity, and a 35-hp. Erie engine for running the crushing plant. Water for the boiler and drills is pumped from a nearby stream with a centrifugal pump.

The laboratory work done at the experimental mine consists largely of drilling, blasting, and mine surveying. In addition to this, some work is given in sharpening steel, timbering, mucking, track laying, hand drilling, and running the power plant. This affords a greater variety of work than can ordinarily be obtained in a reasonable length of time in practice. It is not the aim in this work to make drill runners or miners out of students, but to give them a greater familiarity with mining tools and methods than is obtainable from books and mere observation. This work, supplemented by the eight weeks during summer months of work in practice required of all students as a part of their work toward their degree, gives the student a very good knowledge of mining equipment and methods when he has finished his work and received his degree.

The general region in which the school is situated lends itself splendidly to the study of geology. The school is within easy driving distance of the most important mining district of the state, the pre-Cambrian igneous rocks of the St. Francois Mountains, the extremely complex Decaturville dome and extension, and the many striking unconformities and overlaps of the central Ozark uplift.

The Missouri Geological Survey and the United States Geological Survey both maintain offices on the campus. Several

search work for advanced degrees in geology are carrying on cooperative work with the Missouri Geological Survey.

The specimens in the department of geology number many thousands. Of special interest is the large rock collection of about 10,000 specimens, purchased from Krantz in Germany. The paleontological collections are also unusually complete for an engineering school, and include very extensive set of foraminifera, the study of which has become so important a phase of modern petroleum geology. A stratigraphic set from the state, including all known phases of every formation in Missouri, was started about six years ago and is now about two-thirds complete.

It is probable that the work in map interpretation is as highly developed in this school as in any school in the country, and that the duplicate collection of maps for student use in the laboratory is probably the largest in any institution.

The department of metallurgy and ore dressing has laid out its curriculum and secured its equipment in both physical and process metallurgy. The department aims to substantiate the necessary theory with practical work in the various courses, and is adequately equipped to give the student an opportunity to develop sufficient technic to become immediately useful upon entering his chosen profession. Further, the laboratories are well equipped for original research in pyro-metallurgy, hydro-metallurgy, or electro-metallurgy in the process metallurgical field, and for work on the various thermal, physical and chemical tests, as well as the study of structures, both microscopic and macroscopic, in the physical metallurgical field.

An important feature of the instruction in the ore-dressing laboratory is the

With the movement of the refractories industry westward Missouri has become one of the most important ceramic centers in the world. The discovery of diaspore in this section in commercial quantities has added momentum to the movement.

In 1926 the School of Mines and Metallurgy, at the request of representatives of the ceramic industries in the state, added a course in ceramic engineering to its curricula. The increasing importance of the ceramic industries of the state made such a curriculum at the school an important addition and is tending to make Rolla a center for education and research for ceramics in the state. Special attention is being given to the firebrick industry on account of it being the most important ceramic industry in the state, but particular attention is also being given to the whiteware clays of the southeastern part of Missouri and also to the sewer pipe and the enameling industries.

At a meeting held in Rolla on November 3, 1928, attended by about a hundred representatives of the ceramic industries, a resolution was adopted urging the expansion of this branch of the school, and the coordination of the efforts of the various ceramic associations of Missouri into one all-embracing organization for the purpose of acting before the state legislature to that end. The meeting also urged the establishment of a semi-commercial plant by the school somewhere in the St. Louis district for the purpose of research work in the ceramic industries.

The curriculum of the ceramic department provides for the study of the fundamental sciences and allied engineering subjects, as well as all branches of ceramic engineering. Twenty-six percent

of the course is devoted to ceramic engineering proper, which consists of a study of the properties of the raw materials, the winning operations employed, the refining of the raw materials, their preparation for use, the forming of ceramic ware, the design of ceramic equipment, the layout of ceramic plants, and research and development work on ceramic processes and products. Special emphasis is placed upon refractories.

The chemistry department offers work leading to the degree of chemical engineer or chemical engineer specializing in petroleum refining, and has one entire building devoted to its requirements. The laboratory facilities are modern and complete throughout. The industrial laboratory equipment includes mixing and grinding machines, filter presses, centrifuges, hot air and vacuum-drying equipment, direct-fired and steam-heated kettles, apparatus for distillation and rectification of liquids, for dry distillation of wood, petroleum still for distillation, standard apparatus for oil testing as found in modern oil laboratories, etc., and other similar equipment.

The chemistry department is also charged with the chemical training of the students in other branches of engineering. Comprehensive courses are offered in general chemistry, quantitative analysis, organic and physical chemistry. The mining engineer is given two years of training in chemistry. In the second year the student is given a thorough training in the fundamental principles of quantitative analysis. The use of this branch of chemistry in the evaluation of ores and in the control of mining and metallurgical operations is taught by the actual analysis of ore.

The research program of the school serves as an important link between the school and the industry. Mining and oil companies have sent their employes here to study for a master's degree in order to work out some particular problem in which they are interested. The School of Mines and Metallurgy is fortunate in having on its campus the Mississippi Valley Station of the United States Bureau of Mines, with Mr. Will H. Coghill at its head. Mr. Coghill is one of the foremost authorities on ore dressing. The school has provided four graduate fellowships for research work under Mr. Coghill's direction, the fellows being candidates for the master of science degree. The demand for these fellowships has always been great, and is becoming greater each year. Applications have been received not only from the states in this country but also from Germany, France, Spain, Russia, and last fall one applicant from New Zealand filed his application for consideration for this next fall.

In view of the interest in these fellowships, and especially from foreign countries, Director Fulton is hopeful of soon being able to increase the number of fellowships offered. This year one of the fellows is a graduate of the Freiburg Mining Academy of Freiburg, Ger-

*Airplane view of the School of Mines and Metallurgy and head frame and power plant of School Mine*



many, who came for the sole purpose of studying ore-dressing methods in this country. Through the German Student Exchange and the cooperation of the school he was able to get work with one of the large lead mining companies in southeast Missouri for about 10 months before coming to the School of Mines and Metallurgy, thus giving him a practical knowledge of American methods before he registered here.

In addition to the graduate work in mining, metallurgy, and geology, from six to eight graduate students are enrolled in the chemistry department each year, either in chemical engineering or in petroleum refining, the greater portion of whom are working on problems relating to the mineral industry. Most of these men, after securing their advanced degrees, find employment in the same field.

Director Fulton feels that the mineral industry of the United States owes much to the European mining schools, such as the Freiburg Mining Academy, L'Ecole de Mines of Paris, and the Royal School of Mines of London. It was their graduates who furnished the first pioneering engineering aid to the mineral industry of this country before our mining schools began to function. Now that the American mining schools have developed to their present state of efficiency he feels it is only a fair return that graduates of these older European schools be offered opportunities, and encouraged to accept them, to study in the schools of this country. The applications received from graduates of foreign schools indicate a growing interest in American mining and metallurgical methods, and it is the hope of Director Fulton to be able soon to materially enlarge the facilities for graduate study here by such applicants.

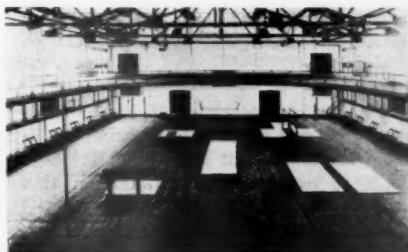
In its research work the school has been of outstanding assistance to the mineral industry. In its cooperative work with the United States Bureau of Mines a cooperative study of the milling methods employed in the zinc fields of

the Tri-State District was carried on over a period of about four years. During this time improvements in milling methods were made by the operators in the district, which engineers have estimated have resulted in the saving of as much as a hundred thousand tons of zinc concentrate annually. A similar program is now under way in the lead belt of southeast Missouri. An extensive study of underground loading machines was also carried on in this cooperative work with the United States Bureau of Mines. In addition to these studies, other researches on a smaller scale have been carried out in the laboratories of the two experiment stations in Rolla.

The school presents the results of these findings to the industry through a series of technical bulletins, which have always been in wide demand from mining and metallurgical concerns. The bulletin dealing with underground loading has gone into practically every country on the globe since it was issued some three years ago.

The school is especially fortunate in its library, consisting of about 33,000 carefully selected volumes, together with a large collection of pamphlets, bulletins and reports of mining companies. The library has one of the most complete files in the Middle West of American and foreign technical journals and the proceedings of scientific and engineering societies. These resources are constantly increased with reference to the different courses of study, while at the same time there is kept in view the development of a well-rounded general library. The bulk of the collection consists of work in the sciences, chiefly geology, physics, chemistry, mining, and the useful arts, the main part of this division being engineering and mining treatises. Besides these collections, the library has the representative works of contemporary American and English literature, a good section of fiction, some biography, and the latest books of description and travel,

Gymnasium floor and swimming pool for students of the Missouri School of Mines



the latter division being kept especially strong, in view of the fact that many of the school's graduates go into foreign countries, so that the students may be informed concerning the manners and customs of the people and the characteristics of the countries into which they are likely to go to follow their profession.

Inter-library loan arrangements exist between the school library and the Library of Congress, the St. Louis Public Library, the John Crerar Library of Chicago, the University of Missouri Library at Columbia, and a number of other large libraries. By this arrangement books not in the collection at the School of Mines and Metallurgy may be borrowed for the use of the students for a limited time.

Realizing that leadership upon the campus is likely to develop qualities that will bring about leadership in the profession and industry later on, the school encourages participation in student activities.

There are student chapters of the American Institute of Mining and Metallurgical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, and local organizations for chemistry and ceramic students. These organizations bring before the students from time to time men high in their various professions. There is a senior council which governs the actions of the students in campus affairs, and an athletic association in charge of athletics. The boards of the school annual, *The Rollamo*, and the student paper, *The Missouri Miner*, are elected from the student body, along with the boards for other activities. A school band and the MSM Players also offer opportunities for student activities, together with all forms of intercollegiate sports.

There are six national college fraternities and three local clubs on the campus, each of which maintains a chapter house.

The engineering scholarship fraternity, Tau Beta Pi, has a chapter at the School of Mines and Metallurgy, and also

the professional engineering fraternity, Theta Tau. Phi Kappa Phi, national honor society, installed its school of mines chapter in 1920, and in the fall of 1925 the University of Missouri chapter of Sigma Xi, national honor society with eligibility for membership based upon an

personal qualities of the applicants other than that shown by the grades in school. The system of rating consists in each faculty member giving its students, in addition to the regular grade on class room work, grades in the following subjects: Intelligence, energy, initiative, leadership, reliability, and personality. Students are graded as superior, average, or inferior in these qualities, and these grades transferred to individual cards for each student. The composite rating of all the faculty members who had the student in class during his four years will give a prospective employer perhaps as good a grasp of the applicant's possibilities as it is possible to get.

The School of Mines and Metallurgy for the past five years has taken active steps to bring its graduating class to the attention of the industries. Printed circulars are prepared each spring, giving a summary of the graduating class, and mailed to a selected list of prospective employers. Through these circulars and the efforts put forth by the graduates themselves there has been no difficulty in finding places for all men receiving their degrees. In fact each year the demand has been greater than the supply, and the past year the demand in some cases was as much as three times the number of men available.

**CLEARING HOUSE** || connection with  
of MINING || business. Not all  
(From page 17) || of them will be as  
wise as they are zealous; therefore, they  
will need to be watched. We should  
see that while they are advancing them-  
selves in popular favor they are not  
destroying our business by foolish exper-  
iments with the delicate adjustment of  
our economic structure.

In this connection, I would especially advise my successor in the presidency of this Congress to take a firm and early stand in favor of cooperation with any and all governmental agencies. I would advise him not to wait to be invited to cooperate; I would that he volunteer eagerly and early. When the affairs of any branch of the mining industry are under consideration, I would not wait to be summoned; I would be sitting on the steps before the doors were opened in the morning. I would be found cooperating before anybody had time to suggest it.

If you are in on the conference which suggests cooperation, you may have a chance to protect yourself; you have practically no chance if you are called into the conference after they have decided what they are going to do to you. My advice would be to be in on the preliminaries. And that is my reason for saying that you need, now, a stronger and better clearing house than you have ever had.



Mine Experiment Station, Missouri School of Mines

# HYDROMETALLURGY at the ADVENT of 1929



## *The March Of Hydrometallurgy Has Advanced Steadily And Now Includes Commercial Extraction Of Copper And Zinc — Tremendous Influence On Non-Ferrous Metallurgy — A Review Of The Present Situation*

By STUART CROASDALE \*



THE march of hydrometallurgy has proceeded in an orderly manner, but the crowd of observers has been diverted by the noise in another part of the field. When I last reviewed the art at the beginning of 1926, it had reached a high peak of progress not only in general interest and research but in scope of application and magnitude of operation. It had leaped the bounds of the precious metal field and had gone into the commercial extraction of copper and zinc and even threatened the time-honored pyrometallurgy of lead. Since that time the wonderful development and application of the flotation process for the concentration and purification of ores has exercised a profound influence on nonferrous metallurgy, just as the automobile has forced a tremendous readjustment in land transportation.

Fine grinding was formerly considered prohibitive and undesirable from any viewpoint. Now it has become an established economic practice, and with it the flotation process has been able to separate complex ores into their component minerals with a high degree of purity, while the often worthless iron pyrite is "sunk" with the gangue.

Flotation has had its greatest effect on pyrometallurgy. Copper concentrates of former years, now freed from the worthless iron pyrite, become a matte grade of concentrate in the form of chalcocite or chalcopyrite, and, in some instances, the copper smelting plant has been reduced almost to a "melting" reverberatory and the converter departments, much to the advantage of the industry. Lead and zinc minerals have been freed from their entangling alliances and are now sent to their respective reduction plants as highly concentrated products.

The lead smelter finds himself, however, with a battery of blast furnaces on his hands and a greatly decreased tonnage to put into them. The finely-divided, high-grade flotation concentrate is also difficult to roast without dust loss, or at least considerable dust in circulation. Crude ores of smelting grade are not plentiful nor so well balanced in fluxing properties as they used to be. As the agriculturist would say, the food is too rich for the cow, and she needs more "roughage" to expand the stomach and keep the organs functioning properly for the maximum milk production.

The hydrometallurgist may be somewhat limited in amenable ores, but he

and thus do away with that remaining relic of metallurgical barbarism.

### GOLD AND SILVER

Chlorine processes of all kinds—chlorine gas, salt roasting and brine leaching with or without metallic chlorides—seem to have been abandoned in this country and throughout the world for the treatment of gold and silver ores, with the possible exception of a few isolated plants in Mexico which may be using the old Patiō process.

The cyanide process has become universal, and in this there has been little or no change. Keeping the lixiviant in an oxidizing or aerated condition for the dissolution of the metals, and bringing the lixivium into a reducing or deaerated condition for their precipitation is still the prevailing practice. The United States Bureau of Mines has done some research work on the regeneration of cyanide lixiviums. The ore used for this work was the old Douglass tailings along the Carson River below Virginia City, Nev. Cyanide loss was excessive, due to the cyanide-soluble copper. A satisfactory regeneration was effected by adding sodium sulphide to the clear pregnant solution in amounts slightly less than that required to precipitate all the metals. The solution was then made slightly acid with sulphuric acid. This precipitated almost all the silver and copper, but only about 10 percent of the gold. After removing the precipitated metals, the solution was made alkaline with lime which reacts with hydrogen cyanide to form calcium cyanide. The solution was then treated with zinc dust to precipitate the gold. Precipitation and regeneration must be done in gas-tight tanks to prevent the escape of hydrocyanic acid. Those in charge of the work report that this is a practicable method for the regeneration of cyanide solutions fouled in this manner.

Cyanide plants are usually placed at the mines or near an ore supply, and the process is usually associated with the treatment of low or medium grade ores which can not be shipped to a smelting plant. There is, therefore, seldom an opportunity to compare hydrometallurgy with pyrometallurgy on a competitive basis. An interesting development of this character has occurred so quietly in Colorado that it has attracted little attention, and yet it is so important that it is worthy of record. Ever since the old mining camp of Creede was given pub-

\* Stuart Croasdale & Company, Denver, Colo.

licity by Richard Harding Davis and Bob Ford the ores from this district have been shipped to the lead smelting plants for treatment. The gangue is wholly silicious and the treatment charges have always been all the ore could carry, regardless of the need of silica for fluxing purposes. The ore is completely oxidized to a depth of 300 ft. or more. The metal values consist principally of silver up to approximately 250 ounces per ton; the ore now shipped from the camp is averaging about 45 ounces per ton. It will also carry about \$1 in gold and the lower grades often carry up to 2.0 percent in lead. The higher grades sometimes carry 3 percent or more in lead, which makes them desirable for smelting. The lead contents, however, are governed more by the location of the mine than by the grade of the ore; the ores from the northern end of the district carry more gold and lead than those from the southern end. There is also a large tonnage of lower grade ore in this district that can not be shipped profitably to any place outside for treatment, but could be treated at a profit for all concerned by a local hydrometallurgical plant.

The Golden Cycle custom cyanide plant at Colorado Springs is now treating Creede ores in direct competition with the lead smelting plants in the state, and, although the smelting charges are reported to have been reduced one-half to two-thirds in order to get this much needed silica for fluxing purposes, they do not yet meet the more favorable treatment charges made at the cyanide plant. The freight charges are the same to both plants. This, of course, applies only to ores containing less than 2.0 percent lead. At the cyanide plant the ore is finely ground—minus 200 mesh—and treated, without roasting, by the regular cyanide process.

Likewise, the very high-grade gold ore from Summitville, Colo., carrying native gold and averaging considerably over 10 ounces of gold per ton, finds a better market at this custom cyanide plant than at the smelting plants. This ore is also wholly silicious. On the other extreme, a quotation recently published (December 1, 1928) and credited to the Golden Cycle Company, was "\$2.50 treatment charge and 50 cents freight on ores up to and including \$4 per ton in gross value" from the Cripple Creek district. This will permit the handling of dump material at a small profit by the owner, and presumably at a profit by the Golden Cycle Company, where the gross value of the ore is much less than the usual smelting charge.

Here is a fair and open competition between a custom hydrometallurgical plant and a custom pyrometallurgical plant for silicious precious metal ores in which the

advantage seems to be much in favor of hydrometallurgy.

#### COPPER

Nearly all the large leaching plants that were installed previous to 1926 are still operating successfully, and new plants have been constructed.

#### Acid Leaching

Late in 1926 the new leaching plant of the Inspiration Copper Company was put into commercial operation. Sulphuric acid is used as a solvent for the oxidized copper but the new feature in the process is the maintainance of a definite amount of ferric sulphate in the lixiviant to decompose and bring into solution the chalcocite and the cuprite. The ore now treated carries from 0.35 to 0.40 percent copper as chalcocite and 0.75 percent copper as oxidized minerals. The plant was built with an estimated capacity of 7,500 tons per day, but it is actually treating nearly 9,000 tons daily.

The plant construction was based on the experience acquired at Ajo, Ariz. The vats, solution tanks, and launders are made of concrete and are lined with pure lead. Antimonial lead, containing 4 percent antimony, is used in most of the pipe. The lead pumps contain 6 percent antimony, and the pump bases about 10 percent antimony. Soft lead is used for the impellers, since it suffers less from abrasion than hard lead. The Byron Jackson vertical screw type of pump is used at the leaching vats. Cimet metal, made by the Driver-Harris Company, of Philadelphia, is used for glands and sleeves over the shafts and it has been found to be very efficient in resisting the corrosive solutions.

The ore is crushed to pass a  $\frac{3}{8}$ -in. screen, but it contains more fine material than the Ajo ore; consequently the vats are bedded evenly over the whole area in order to get as homogeneous mixture as possible and prevent channelling. Upward percolation is used through a false bottom of 2-in. planks in which  $\frac{3}{8}$ -in. holes are bored.

The lixiviant contains from 5 to 7 percent sulphuric acid and 1.0 to 1.1 percent iron as ferric sulphate. The controlling factors for efficient leaching are (1) solution temperature, (2) percentage of ferric sulphate, and (3) time. All these are interrelated so that any deficiency in one must be balanced by an increase in the others. The temperature of the lixiviant is maintained between 37 and 47 degrees Centigrade. Artificial heating is necessary in the winter time. The ferric sulphate is maintained at an equilibrium where it is in sufficient amount to decompose the chalcocite and yet not interfere with the electrolytic deposition of the copper. This point has been found to be between 1.0 and 1.1 percent of iron

in ferric condition, as already stated. The ferric sulphate was not added as a salt, but was gradually built up in the lixiviant by oxidation, in the electrolytic tanks, of the ferrous sulphate accumulated in the process of operation. The presence of copper seems to have an important bearing on the oxidation of ferrous sulphate to ferric sulphate in any solution, whether electrolysis is used or not. The time of leaching is eight days instead of 10 days as determined by the experimental plant.

The copper is precipitated electrolytically with a current density of 15 amperes per square foot and a voltage of 2.35 between the cathodes. The ampere efficiency in precipitation is 66 percent. The power required per pound of copper produced is about 1.50 kw.-hr. of alternating current, the conversion efficiency being about 93 percent. The anodes are lead and the cathodes are copper. The starting sheets are made from ordinary converter copper obtained from the local smelting plant.

The lixivium is "bled" periodically to keep the impurities under control. The copper from this waste solution and from the excess of wash water is precipitated on scrap iron.

The tailings from the leaching operations average about 0.17 percent copper, making the recovery about 20 pounds of copper per ton of ore.

The cost of the plant was \$5,840,000, or approximately \$650 per ton of daily capacity. The operating costs, as published for the first seven months of 1927, vary little from month to month, and since they are all that I have available, they will probably represent a close average of the operating costs to date; with accumulated experience and efficiency, the average cost to date is not likely to be any higher. These are given alongside of the estimated costs as determined from the Ajo experience and from the operation of the experimental plant. The figures show the remarkable accuracy of the experimental work:

	Estimated cost per ton	Actual cost per ton
Crushing to bedding ....	\$0.109	\$0.108
Total leaching .....	0.301	0.276
Total .....	\$0.410	\$0.384
Total precipitation cost per pound of copper....	\$0.0210	\$0.02196

On the basis of a recovery of 20 pounds of copper per ton of ore, the above figures resolve themselves into a total metallurgical cost of \$0.824 per ton of ore treated or \$0.0412 per pound of copper produced. When one considers that the construction cost of this plant per ton of daily capacity is approximately the same as that of a first-class concentrating plant; that the operating cost is but little if any higher than the cost of concentration during the same period; that the recovery

is fully equal to that obtained by concentration from the same grade of ore; that the ore treated could not have been handled profitably by any other process of ore dressing or metallurgy; and yet the result is refined electrolytic copper direct from the crude ore instead of a concentrate to be subsequently smelted and refined, the merits of hydrometallurgical processes become more apparent.

At Chuquicamata, the Chile Copper Company is using wood stave pipes to handle their copper-bearing solutions. These are manufactured locally. The use of mastic lining for the vats has been maintained and, after a long period of experimentation, a satisfactory construction has been developed that will stand temperature strains and other severe requirements, as well as form a perfect bond on concrete. This is cheaper than lead. The latest development is an all-mastic tank construction which gives promise of success.

#### Ammonia Leaching

Ammonia leaching continues in vogue at Kennecott and in the Michigan copper district. In Michigan it has been supplemented by flotation to recover the native copper that is not attacked by the ammonia solution. At B'wana M'Kubwa, Africa, a process has been developed by the Minerals Separation Company to meet the conditions peculiar to the treatment of those ores. The copper silicates are first broken down to the oxide by roasting at a dull red heat. Producer gas is then brought in contact with the hot ore to effect a partial reduction to a spongy metallic condition. Ammonium carbonate solution is then used for leaching and the copper is precipitated by driving off the ammonia, which is recovered in the usual manner.

#### Heap Leaching and Leaching Ore in Place

At the best, this can be considered only as a means of recovering a waste product; that is, recovering the copper from mineralized material that is too low grade to mine, or from waste material that has been removed in the production of ore. The process consists of running mine or flood waters over the scrap iron. At Bisbee and Cananea it has become a method of neutralizing the copper-bearing mine waters from stope fillings and from the old fire stopes. The precipitation launders are placed underground ahead of the pumps. Air agitation is introduced into the launders to keep the iron clean. The process, therefore, serves a dual purpose of pump and pipe protection and of leaching ore in place. At Pinto Valley, Ariz., the crushed ore is placed on platforms surfaced with asphalt and is then sprayed with a weak solution of sulphuric acid and ferric sulphate as a substitute for the flooding

system. This is in the experimental stage and is supposed to effect a better oxidation of the minerals.

In Utah, the Ohio Copper Company continues to leach their old filled stopes by flooding. After a long period of experimentation, the Utah Copper Company has begun the construction of a precipitation plant to recover the copper from the aerial waters that flow through the immense tonnage of over-burden that has been dumped into the neighboring gulches. This plant will be in operation soon after the first of the year.

The cost of producing cement copper in this manner approximates 5 cents per pound, to which must be added the cost of smelting and refining or about 2.8 cents per pound. It is evident that on the basis of operating costs, it has no advantage over a well equipped leaching plant.

#### ZINC

I quote the following from the bulletin of the American Zinc Institute for November-December, 1927:

"Not long ago one of our authorities on zinc said, 'electrolytic zinc is a mere laboratory experiment.' In strong contrast with this rapid progress in making zinc electrolytically, is the present idle capacity of the zinc retorts of the old process. Some say only two out of every three retorts are operating today; others declare that only a little over 50 percent of the retort capacity is now working."

The following table, compiled from the trade journals, shows the growth in hydrometallurgical production of zinc since 1926. Surely the industry is far beyond a "laboratory experiment." It must be remembered that zinc statistics are stated in tons of metallic zinc produced and not in tons of ore treated.

WORLD PRODUCTION OF ELECTROLYTIC ZINC		
	Output in tons, 1926	Capacity in tons, 1928
Anaconda Copper Mining Co., Montana .....	113,000	180,000
Sullivan Mining Co., Idaho .....	.....	18,000
Consolidated M & S. Co., Canada .....	62,000	125,000
Electro-Zinc Co., Australia .....	50,000	50,000
Miscellaneous .....	6,000	10,000
Total .....	281,000	388,000

This is an increase of 66 percent. In 1926, electrolytic zinc constituted about 17 percent of the world's production of metallic zinc. The metallurgical capacity for 1928 is over 25 percent of the estimated world's production for this year. The production of electrolytic zinc in the United States is now about 30 percent of the total production in this country. This does not include the hydrometallurgical processes involved in the manufacture of lithopone and zinc salts which are close to the border of chemical industry.

The lower grades of retort zinc are increasingly hard to sell. The demand is for pure metal, just as purity is demanded in other commodities. The flotation process has thrown on the market a large quantity of high-grade concentrates from complex western ores that were not available heretofore for the zinc industry. These concentrates are especially adapted to hydrometallurgical treatment.

Pyrometallurgy of zinc seems doomed to a steady decline if not total elimination. The Electrolytic Zinc Company of Australia, is now planning expansion. The Russo-Asiatic Company, of London, is engaged in extensive mine development in Australia on a complex ore deposit. After concentration by the flotation process, it seems improbable that they will do otherwise than treat their zinc concentrates hydrometallurgically. The mine, metallurgical, and hydro-electric development in the Flin-Flon district, Canada, points only to the same conclusion. The increased hydrometallurgical capacity in the United States during 1928 consisted principally of the new plant of the Anaconda Copper Company, at Anaconda, Mont., having a capacity of 165 tons of zinc per day, and the new plant of the Sullivan Mining Company, at Kellogg, Idaho, having a capacity of 50 tons per day. It is proposed to increase the last named plant to 150 tons daily capacity as rapidly as possible. Plans have also been consummated by the Evans-Wallower Lead Company to erect a similar plant at East St. Louis during the coming year which will have an initial capacity of 50 tons daily. An effort is also being made to establish a plant at some favorable and central location in southwestern United States.

#### Acid Leaching

The only modification developed in acid leaching is that known as the Tainton process which is used by the Sullivan Mining Company, at Kellogg, Idaho, and will be installed in the new plant at East St. Louis. I quote a description of this process from the bulletin of the American Zinc Institute, Inc., for November-December, 1927:

"The process differs from that used at Trail by the Consolidated Mining & Smelting Company, and at Great Falls by the Anaconda Company, in that there is a single leaching circuit instead of a combination of acid and neutral circuits, and in using leaching solutions of higher acid strength, and in using higher current densities in the electrolytic department. Wedge roasters, modified slightly from the standard design, will be used. The calcine is to be divided by Dings magnetic separators into two portions, one being comparatively free from ferrites and the other containing nearly all of them. A novelty of the process is the separation, by means of which it is possible to start a leach charge with calcine

containing ferrites and finish it with calcine of the second class. As a consequence, the ferrites can be effectively attacked with the strong acid at the beginning of the cycle, whereas the less refractory portions of the calcine can be used to finish the cycle when the acid has lost much of its strength and leaching action. Agitation will be by mechanical means instead of air-lifts, and Burt pressure filters will be used for recovering the zinc-bearing liquor. Fumes from the roasters will be passed through a Cottrell treater before entering the 250-ft. brick stack."

In addition to the above, I will quote from an article just published by Mr. Tainton himself.\*

"The plant was erected to treat the zinc-bearing ores of the Coeur d'Alene district. These ores can not be classed as particularly favorable for electrolytic treatment, inasmuch as they tend to form an unusually large amount of insoluble zinc ferrite in the roast, and they also yield considerable quantities of gelatinous silica in the leaching operation. In addition, they contain relatively large amounts of cobalt, which is one of the most troublesome of impurities from the standpoint of electrolytic zinc treatment. For these reasons the Sullivan plant has been designed to make use of the high-acid process described by me in previous publications. In this process the return electrolyte used for leaching carries 28 to 30 percent free acid, and the electrolysis is carried out at a current density of 100 amperes per square foot, both of these two amounts being about three times as great as the corresponding figures in ordinary electrolytic zinc practice. \* \* \* The magnetic separators take out from 30 to 50 percent of the calcine and this drops directly to the 'Ferrite' bins below. That portion which is non-magnetic drops over the end of the belt and goes to the 'Oxide' bins. \* \* \* In starting a charge, return electrolyte, previously heated to 60 degrees Centigrade, is pumped into the agitator tank. A charge of ferrite is then run in, a quantity of manganese added to oxidize the iron, and the tank allowed to agitate for one hour to permit decomposition of the zinc ferrite. The feeder of the 'Oxide' bin is then started and addition continued until all of the iron is precipitated, as shown by a test with thiocyanate spot paper. Before the end of the reaction the pulp comes up to boiling temperature and considerable quantity of water is evaporated, steam being provided to take care of the steam evolved. After the charge is neutralized, the pulp is dropped into a storage tank of the same size as the agitators, and thence it feeds to the Burt filters."

The solution from the Burt filters is purified from copper, cadmium, and cobalt in the usual manner by agitation with zinc dust at a temperature of 80 degrees Centigrade. The purified solution is then cooled and sent to the electrolytic cells.

There are many apparently small but important details that have arisen but have been cleverly and successfully worked out in the operation of the proc-

ess. For a description of these, the reader is referred to the original article. Mr. Tainton states finally: "The average grade of the metal so far produced has been consistently above 99.99 percent."

#### Ammonia Leaching

This process has been investigated at the Salt Lake Station of the U. S. Bureau of Mines, at the Colorado School of Mines, and at the Missouri School of Mines. A summary of these investigations seems to be that:

(1) If the ore is efficiently roasted, the extraction of zinc by ammoniacal lixivants (ammonia and ammonium carbonate) is as high as that obtained by acid leaching.

(2) There is no more difficulty in the manipulation of this process on zinc ores than there is in the treatment of copper ores.

(3) Electrolytic precipitation shows the same efficiency from ammoniacal solutions as it does from acid solutions.

(4) Ammonia is now a cheap solvent and the leaching equipment does not have to be protected from corrosion.

A year or two ago a pilot plant, having an ore capacity of 40 tons daily, was built at Salida, Colo., to demonstrate the Gordon-Keith process using gas-liquor as a lixiviant. Soon after the plant was completed, the principal benefactor died and the affairs of the company fell into the hands of the estate, so the demonstration was not completed. An effort is now being made to reorganize the company and go on with this work.

The experimental plant of the Standard Metal & Chemical Company at Denver, Colo., that was used to demonstrate the Malm chlorine gas process for the treatment of complex ores, has ceased operations.

#### LEAD

There is nothing new to record in the hydrometallurgy of lead that has come under my observation since 1926. Tainton has demonstrated what can be done by the continuous operation of a pilot plant on a tonnage basis at Kellogg, Idaho. Van Arsdale has operated an experimental plant continuously over periods of several months. Both these investigators have demonstrated their reliability in regard to metallurgical results and cost of operation so it would appear that sufficient data are available on which to plan a commercial plant. Both investigators have used chloride solutions.

There is no apparent reason why the hydrometallurgy of lead should not follow the trail made in the hydrometallurgy of zinc. The outlook is just as promising. This will become more urgent as the quantity of high-grade lead concentrates increases from the use of

selective flotation on complex ores, and there is less crude ore to supply the present type of blast furnace.

#### RARE METALS

Vanadium and its allied metals are extracted from the oxidized Colorado ores by hydrometallurgical processes. The vanadium is sold as an oxide. Molybdenum, principally in the form of molybdenite but partly as the oxide, is extracted in large quantities from the low-grade ores of Colorado and elsewhere in the form of a high-grade concentrate by means of the selective flotation process. It is sold in this form to the ferro-alloy and chemical industries.

#### U. S. LEADS IN RAPID INCREASE IN WORLD'S COPPER PRODUCTION

The world's production of copper during 127 years, since the beginning of the nineteenth century, amounts to more than 40,000,000 tons, according to Scott Turner, Director of the Bureau of Mines. The increasingly important part played by the United States in supplying the world with copper is interesting and significant, Mr. Turner points out, in referring to an economic study of the production of copper during the nineteenth and twentieth centuries, which has just been completed by C. E. Julihn and the Common Metals Division of the Bureau of Mines. The United States has produced more than 19,500,000 tons of copper, or 48 percent of the world's output since 1800, although the production of this country was negligible prior to 1850.

The results of the Bureau's study are given in Economic Paper No. 1, "Summarized Data of Copper Production." While the Bureau publishes annual reports of the production of the various industrial metals, detailed long-time records of production have not been available.

The present report on copper is the first of a proposed series of economic papers to be prepared by the Bureau's Common Metals Division, which will present similar analyses of long-time production of other metals such as lead, zinc, iron, chromium, manganese, nickel, aluminum, tin, gold, and silver. Another group of papers on resources is in contemplation, and eventually the Bureau hopes to present papers dealing with distribution or industrial flow and ultimate consumption. Economic papers discussing the opportunities for American citizens or corporations to exploit foreign mineral deposits will also be prepared.

Copies of Economic Paper No. 1, "Summarized Data of Copper Production," may be obtained from the United States Bureau of Mines, Washington.



THE subject that has been assigned to me is entirely too broad and too big for my capacity. I am no prophet. I was asked to foretell the future of non-metallics. It is so all-embracing that I can not begin to cover it, and the best that I can do is to talk to you about a subdivision of that big subject with which I have lived for the last 25 years.

Having migrated from Maryland to the great Empire between here and the Rio Grande, I have cast my lot and grown up in that country and adopted its point of view, and I want to tell you that there is no man living today that can predict the great future of industrial development of that Empire.

So I shall center my remarks as best I can about one of the subdivisions of the non-metallics—clay, burned-clay products.

The dean of our profession says, "God made man out of clay and fired him." The more you think of that statement of Herman Mueller, the great poet of Trenton, N. J., the more you can see his meaning.

God made man out of clay and fired him. What would man be today if he had not been fired? The animate and the inanimate. A man must have enthusiasm—which I believe comes from the old Greek word "Entheos"—God in you—a man must have enthusiasm, and then he can do something, and man without it is a failure.

The total of the burned-clay products of America as given by Government figures amounts to \$459,000,000. That is about 8 percent of the total of all the mineral resources of the United States. Of course that has had introduced into it some skill, because it has been manufactured. As to predicting what the future will be, you have got to judge it by its past and bring it up to the present, and project its future. The figures

\* Presented to Thirty-first Annual Convention of The American Mining Congress.  
† President, B. Mifflin Hood Brick Company.

## The FUTURE of NON-METALLICS\*

By B. MIFFLIN HOOD †



*THE Civilizations Of The World Have Been Perpetuated Through Burned Clay—Tile Roofs Universally Used Except In America—The Age Of Clay Now Superseding The Age Of Wood*

that I have obtained from the Department of Commerce show an increase since 1913 in face brick of from \$9,000,000 to \$44,000,000. That is one of the products of the South to which I have devoted my life. I started the first rough texture shale face brick and got my first order at Loyola College, in New Orleans, when I could not sell them in my own town.

Tile has grown from \$6,000,000 to \$34,000,000. The women have become the big users of that product, and today our bath rooms have changed from a bath of white tile, suggesting to you in the morning the shivers of cold winter, to suggesting to you those beautiful soft

tints. That is one of the reasons that that industry has grown.

Fire brick has grown from \$16,000,000 to \$42,000,000.

Pottery, again, with woman's discernment of taste and appreciation of style in design and of character—has grown from \$37,000,000 to \$116,000,000; china and porcelain from \$8,000,000 to \$22,000,000.

When Donatello was working with his matchless art in the metals, in the Renaissance period, Delorme was working in terra cotta, and Michael Angelo on that matchless piece of architecture in ceramic materials, in St. Peter's Basilica at Rome.

Then in the mosaics we have preserved to us imperishably, the history of the past.

It was my good fortune to spend six weeks in the Roman Forum under Dr. Forbes, the archaeologist who went into Rome in 1870 when Garibaldi and Victor Emmanuel broke down the walls. For six weeks I roamed around in the Forum and around about Rome, and to my great astonishment I found in the ruins of that ancient city that the best preserved products were of clay that had been fired with coal. It is heat that gives permanency to the character of the material that the artist has molded, and without that heat we have no permanency and no character to preserve.

Over on the Palatine Hill from which the legend of Romulus and Remus has come to us, has been reared the great palace of the Caesars, of the days of Julius and Augustus, and there you can see wonderfully preserved those Roman arches of brick and mortar still defying the ages and telling you of the rugged strength of Roman architecture when masonry was used.

Down under the Coliseum stand the Roman arches of brick and mortar that carry the superstructure of stone; and out on the Appian way stand the ancient baths. It was a diversion of the Roman

days to go there and take a bath and then play "African golf."

A commission was formed in Rome, Italy, soon after Rome became the re-united capital of the Italian empire, to ascertain how best to preserve these beautiful ruins of Rome and draw to them each year a crop of tourists; and there you see today on the Coliseum, to preserve it, a rowlock of burned clay on stone to keep down disintegration and erosion and prevent them from tearing down that stone. That commission selected burned clay as the imperishable product which was to preserve the stone for the superstructure of the Coliseum.

Had it not been for burned clay we would not have today preserved to us the priceless records of civilization or know anything about the Hittites except in Holy Writ.

The great German archaeologist was about to despair of ever finding a record of ancient civilization except in Holy Writ, but just as he despaired he discovered some burned clay tablets telling us that the Hittites antedated and occupied and overflowed all of that country now known as Mesopotamia, Assyria and Babylonia, thus verifying Holy Writ; and it is to burned clay that we owe our obligation for having preserved this to us and thus giving more credibility to the story in the Bible.

I want to interject here an illustration that is aside from my subject.

For seven weeks I traveled with Robert Dollar, to my mind the greatest salesman in commerce today. Of course I consider Colonel Lindbergh the greatest salesman in this entire generation, dealing in good will; but Robert Dollar, to my mind, and from very close personal contact with him for seven weeks, is the greatest salesman in commerce.

In order to get the products of that province that lies away up the Yangtze River, occupied by 60,000,000 Chinese, and to bring out certain products that we are depending upon today from that country as raw materials, he had built steamboats with twice the power that any other steamboats had ever been built with, to go back into that country and bring out raw materials and carry back manufactured products to the western world.

What do you suppose happened? The natives up and down that river shot the crews of the ships, and when they were approached and asked about it they said, "For a thousand years our ancestors before us had row-boats up that river and brought back raw materials and carried back the merchandise, and these foreign devils are taking away our livelihood."

And what was that livelihood? For six weeks a man would contract with a Chinese foreman for 60 men to man a junk and bring goods down the river

with the rapids, unload, load back, and for three meals a day and about \$1.04—that is, 2 Mexican dollars, 2 times 52 cents—he would do 6 weeks of work under great hazard.

At one place up the Yangtze River there is a place akin to the Gorge of Niagara, and there the men had to lean over there with a bamboo and a hawser over their shoulders, and let any one neglect his duty, and the chief would strike him with a heavy cane. Sometimes men would drop down there and would be drowned.

For three bowls of rice, six weeks of work and hazard, these men shot up the crews of those ships.

The point is this. If there is one thing in which America excels above all other things, it is in the application of mind to matter. The Americans can produce more for the highest standards of life than any people in the world. We can not take the Chinese story; we have got to have the American story of the application of mind to produce the maximum and thus maintain the highest standard of any country in the world.

Pardon me for that digression.

The time came in my business when I had to find some product that I could manufacture that nobody else was making in the Southern States. There is a reason for that. The theory that we worked on has been this, that if we could produce something in a burned-clay product that nobody else was producing within that great empire we could give our customer a large share in the saving on the freight rate, run 12 months of the year, and increase our volume, and we have worked on that line.

We are emerging out of the wood age into the fire-resisting age of ceramics. In other words, we are in a line of business that is increasing and expanding with the growth of the country and the higher standards of living. By research it is up to us to make a study individually in our own business to find a product that is not being made, learn how to do it well, and then have the faith so thoroughly ingrained in you that you can defend that faith and so spread the gospel to the consumer that you have lined up for that product.

So this is what happened. I said, "We have got nine plants. I do not want to shut any down. What can we make?—because we are facing the situation that came on after the Florida peak, and Florida and California are the largest consumers of roofing tile."

So I went around the world and looked at every country. I looked at their different processes, and I asked the people of every country why they used roofing tile. I tried to get their reaction. I was very much fascinated with a Japanese who was riding down on the train to

Kobe. And the result of the conversation was this, that he was an intellectual of Japan, educated in Europe. He grieved that they had no inventive genius in all the Japanese country like our Thomas Edison. He said they were good imitators. I asked him about roofing tile, and I found in all Japan, in all their cities, the people live under burned-clay tile roofs, and the reason for it is that they are afraid of their enemies, Asiatic cholera, bubonic plague, typhus, earthquakes and conflagrations. The streets are very narrow, and as my lady walks down the street with her beautiful Japanese silk we find that the motor cars have to wear from the hub down a long piece of rubber with little slots in it to keep the slush from getting on the silks.

The danger of conflagration is such that they may be wiped out of their homes in a single evening.

When you go over to China and ask them why they use so much roofing tile, the poor classes have unbaked tile on their roofs and the richer classes have baked tile—you find that they consider it a protection also. Whenever you go they wish you long life and good luck—because what is the use of good luck without long life, and what is the use of long life without good luck? I admire their philosophy.

You go to Manila and you see the great Spanish civilization that has come over there. Everywhere that the Spanish went they carried with them the tile roof.

Down in Singapore I found that all the houses seemed to have rafters of bamboo and the thinnest tile that I have ever seen anywhere else in the world, less than an eighth of an inch thick, fitted over the bamboos, and then another, and not a nail anywhere, but lime mortar. I asked them why they used tile roofs, and they said, "We are within a degree of the Equator. The sun comes straight down and it comes down with a penetrating heat, and we have found nothing that protects us from the sun's rays like burned clay."

The same is true of India and Egypt.

When I got to Italy I found tile 90 percent plus, and I asked why, and was told that it was because the Romans did it. "We are strong for precedent. If anybody in these 2,000 years could have brought us something better than what the Romans used 2,000 years ago, we would use it; but nobody has brought it."

I visited South Germany and all that wonderful country there, and found tile roofs, and when I asked a German why it was he said, "I build not for myself only but for my children's children's children's children—permanently."

Up in Scandi- (Continued on page 69)

# HOW ANTHRACITE *is* MEETING COMPETITION\*



## *Anthracite Has Its Flag Nailed To The Mast—It Has Something To Say For Itself, And It Is Saying It Forcefully, Aggressively And Effectively—The Problems Of The Industry Graphically Presented*

By ALBERT B. JESSUP †



Were it not for the seasonal purchasing habits of the anthracite consuming public and their erratic calls for one or the other of the four or five domestic sizes constituting only two-thirds of the output, the industry could be regarded as considerably over-developed. It is probable that 10 percent of the colliery capacity could be dispensed with if through steady absorption of all sizes as produced operations could be highly concentrated and full time worked. But to carry it over peaks of cold weather demand for favorite sizes there is required expensive over-capacity often idle, and surplus man power, or equally expensive storage of, say, 3,500,000 tons in dull markets as at present.

These general facts in relation to this great basic industry, which employs 165,000 men, and whose total sales realization at the mines amounts to about \$450,000,000 per year, would indicate to the casual observer an ideal commercial enterprise of great magnitude and hope of reward.

But anthracite history reveals its repeated difficulties, commencing long before the fuel industry of the world be-

came over-developed, demoralized, and generally unprofitable. It can not be said that during the past quarter century the anthracite industry itself has been held in such high esteem as has its product. It is difficult for those close to the industry to assign any sound reason for this peculiar twist of the public mind. A guess would be that certain transportation interests who formerly dominated the industry's policies and destinies were deemed by the public to be intolerant and arbitrary in their attitude; but this is ancient history.

Today the anthracite industry in its public and industrial relations rightfully regards cultivation and retention of the confidence and good will of the public and of labor as a fundamental prerequisite to its success—a first step toward meeting competition.

It would not be responsive to the subject, nor will time permit more than a brief reference to earlier history of anthracite; how the railroads and canals acquired vast anthracite reserves to ensure future freight traffic and encourage outside capital to lease and develop portions of those lands, later reversing this policy and producing three-fourths of the output and holding 96 percent of the reserves; how the long-drawn-out struggle between the Government and the railroads to prevent the latter from producing the anthracite transported by them created a certain distrust of the industry, and public opinion caused the Hepburn Act to be passed in 1906, to bring about complete segregation of transportation and coal mining when previous laws could not accomplish it; how the segregation was delayed until carried out to the Government's apparent satisfaction under the Supreme Court's decision of 1921.

Mr. E. W. Parker has well summarized this phase of the industry as follows:

"That the coordination of the mining and transportation interests in the early days of the anthracite industry was necessary to secure its development, there is scarcely any doubt, though it may be admitted that through these various affiliations there arose in the later history of the industry certain abuses such as discrimination against operators not affiliated with or subordinate to the railroad interests, but it has never been shown, nor is it probable it could have been shown, that the public has been the sufferer. Persistent attacks upon the association of railroad and mining interests as creative of and fostering monopolistic control and therefore contrary to the public welfare, were successful in reversing the attitude of the government toward the industry and through legis-

FOR over a century anthracite has been commercially produced from a compact coal area of 500 square miles in northeastern Pennsylvania, and has been the chief domestic fuel of a territory wherein about 75,000,000 people reside. Twenty-seven states with near-by parts of Canada form its principal markets, which are limited chiefly by transportation costs. Approach to the great bituminous producing centers on the west and south, of course, reduces its use in those directions, but its markets may be approximately defined as lying within the confines of the Missouri, Ohio, and Potowmac Rivers.

There are ample anthracite reserves. Engineers of the U. S. Coal Commission estimated about 16,000,000,000 tons in the ground, of which only 9,000,000,000 were recoverable, leaving quite an item of economic waste initially challenging the ingenuity of engineers.

About 69,000,000 long tons are marketed in a year of good working time, say, 265 days, while plants and developments are ample to produce about 90,000,000 tons in a year of full working time. The facilities of a dozen great railway systems are available for anthracite's transportation to markets in 27 states, the most densely populated and fastest growing portion of the United States. Great sales organizations distribute most of the product, while approximately 14,000 retail coal merchants are said to have \$400,000,000 capital invested in facilities for distributing this great fuel.

The value of coal lands, collieries, and equipment was estimated by the Coal Commission's advisory engineers as \$990,000,000.

The question of sufficient annual production becomes, therefore, subordinate to that of distribution. Only when at the termination of labor contracts have the workers refused to continue production pending execution of a new agreement to their liking has the anthracite industry failed to produce the annual requirements of its consuming territory. The frequency of these unfortunate suspensions in the past is alone responsible for any impression that anthracite deposits are not sufficiently developed and anthracite plants inadequate to meet the needs of those who desire to use that fuel.

\* Presented to the Thirty-first Annual Convention of The American Mining Congress, Washington, D. C.

† Vice President and General Manager, Jeddo-Highland Coal Company, and Acting Chairman, Production Committee, Anthracite Operators Conference.

lation and litigation the relations formerly encouraged have been determined as in restraint of trade and as having outlived the useful purpose for which they were created."

But this is now water over the dam, and the industry stands foursquare with the adjudicated laws of the land. Nor is it necessary to mention how continued suspicion in the public mind with respect to anthracite resulted in more than a dozen comprehensive investigations being undertaken by governmental agencies in the last quarter century—the initial investigation of the Anthracite Coal Strike Commission in 1902 serving to place anthracite's labor relations on an orderly basis for the first time in nearly a century of operation; how practically all of these investigations finally proved to be based upon unfounded suspicion and merely developed conclusions meaning little more than that the industry had no greater shortcomings than had any average industry run by twentieth century human beings. And let it be said to the industry's credit that honest efforts have always been made to correct such defects as came to light.

To this drab background of what was generally regarded as a natural monopoly and artificial combination, a few more depressing items must be added to portray the growth of ever-present competition. The industry was just emerging from a trying period of over-production when the long strikes of 1900 and 1902 occurred. The Roosevelt strike commission of 1902 laid the foundation for industrial peace, but again there were strikes in 1906 and 1912.

Five wage advances were made between 1912 and 1918, but the three war measures advanced to offset increased cost of living raised the production cost 50 cents per ton more than the corresponding price authorizations granted by the Fuel Administration and supposed to compensate for them.

President Wilson's commission of 1920 then boosted wages to an index of 262, compared to the cost of living peak of 213. Then strikes occurred in 1922 and in 1923, and at the end of the latter Governor Pinchot imposed a 10 percent increase, with other concessions which brought the already inflated wage index to 292, whereas the cost of living had then fallen to 173, where it has since been pegged. In 1925 this contract ran out and a six-months strike ensued. Wages were left unchanged, but provisions for binding arbitration were agreed to, an innovation in which great hope for the future is placed.

With a wage index so far out of line with economic conditions and far above those of workers in other industries, anthracite prices became so high as to be a burden upon less favored wage earn-



ers needing the fuel. Anthracite fields were being made fertile for the growth of competition.

Competitive fuel, having its foot in the door, edged in a bit farther.

But it must not be assumed that during all these years anthracite has had no competition, for so early as 1902 the Anthracite Coal Strike Commission said, with its uncanny foresight:

"Anthracite, though regarded largely as a necessity, is not free from competition and unreasonably high prices limit the use of it. As has been said, the price of the 'steam' sizes, which are about 40 percent of the total production, is influenced by and controlled through the competition of bituminous coal. The 'domestic' sizes, at reasonable prices, are always certain of a fair market, but when the prices become abnormally high the economy practiced in its use and the competition of gas and oil ranges and stoves are directly felt and limit consumption."

Owing to the gradual exhaustion and the consequent greater expense of mining the poorer veins, and the increased labor cost due to higher wages, the tendency of the price of anthracite coal is probably upward. The effect of higher prices will undoubtedly be to limit consumption."

But it remained for the industrial dislocation caused by the World War to swell this ancient competition to its present magnitude. The Fuel Administration prohibited shipments of anthracite to certain distant markets, whose consumers were driven to change their equipment to burn substitute fuels. This, coupled with high transportation rates and over-production of bituminous, has made these markets difficult to regain, but repeated and protracted general strikes in the anthracite region have been the greatest single factor in curtailing anthracite consumption and letting com-

petitors in. Repeated interruptions of steady supply caused severe coal shortages and created an indelible doubt in the consumers' mind as to any continuity of their anthracite supply. John L. Lewis, president of the U. M. W. A., said of this in 1927:

"It is incontestable that strikes and suspensions of production for long periods are matters of inconvenience and irritation to anthracite consumers and leave a malignant influence in their wake. . . . The industry is still suffering from the baneful effects of that memorable (1925-26) contest, and at many points the anthracite product has not yet regained its former commanding position."

Customers having learned to use other fuels, producers of low-volatile bituminous, coke, oil, gas, and electricity were quick to take advantage of the situation.

The continued growth of this competition was such as to prompt the Hon. Herbert Hoover to say in 1927:

"The anthracite industry is not today a monopoly which can impose its commodity and its prices upon the public. The development and use of gas, coke, oil, smokeless coal, electrical current have all to some degree entered the special market occupied by anthracite, and it must compete with them."

Mr. S. D. Warriner, spokesman for the operators, also said:

"We can no longer consider ourselves distributors of a necessity of life; we are now, like other merchants, selling a commodity of service in competition with other merchants, and the gauge of our success or failure is the service which we render as compared with the service rendered by our competitors."

So the ideas of Government, labor, and operators seem to be in accord on competition and the reasons for its growth.

With such a history as a background, it is a marvel that the industry has even

retained its prewar volume of use, but all that anthracite has really lost to a steadily increasing volume of bituminous coal, to the substitute use of low-volatile bituminous, coke, gas, oil, electricity, water power and other similar competitors is that natural increment of increase in tonnage it should have had from normal increase in population, in building construction, and in power generation. Its production has taken no backward step, it merely remains that of prewar days. Twenty-five years ago, however, the maximum limit of the annual production was assumed to be between sixty and seventy-five million tons, after which the production would fall off as gradually as it increased.

Urgent necessities in recent years, coupled with fierce competition from within and without, have given great impetus to and done much toward the solution of the complex fuel problem of the world. Common necessity has forced previous individual overlapping efforts to progress into collective endeavors by groups, by industries, by nations, and even now 48 nations have pooled their resources in the World Fuel Bureau to gather the world's knowledge of fuel.

Activities in the anthracite industry continued on an individual basis rather longer than in other industries, but none the less intensively. There was overlapping and duplication, but substantial progress was made along all lines. For a century the majority of the industry was not driven by the urge of need to put forth exceptional efforts to meet such sluggish competition as confronted it. But this was not true of the minority, for it had but one string to its bow in the matter of income, and much credit for progress in the industry is due to the initiative and energy displayed throughout by the so-called "independent operators." But the principal mining companies were to a large extent appendages of the railroads. So long as they provided traffic and the joint returns seemed to suit those in power, they did not bother much about making the most money out of the mining end. What is now one of the few large earners among anthracite producers did not make a dollar for 40 years while under railroad tutelage. Far-sighted executives might have looked into the future anticipating present conditions and years ago adopted more progressive methods, but they were rather remote from the actual industry itself, the urge of need was not there, and human nature prevailed.

I hold no brief for those who at one time dominated the policies of the anthracite industry, but for those operators and engineers who produced the coal I have nothing but the highest admiration and praise. Many of them are now the

guiding spirits of the anthracite industry, whose aroused activities redound to their credit. No abler group of mining technicians could be found the world over, and my sole criticism would be that they too long continued their individual activities instead of pursuing them collectively.

Now under the urge of necessity anthracite is exerting itself effectively in so many directions that it is difficult to cover all of its activities and at the same time avoid making these remarks sound like a catalogue of progressive steps. It is not without interest, however, to survey these activities that an old industry, aroused from complacency, has taken in the last three or four years. It is, I believe, a most creditable record when it is considered that its present policy is the reverse of the old one and that much of it had to be improvised in a hurry without carefully constructed organization and without guideposts.

First and foremost in the accomplishments of the industry's effort to cope with competition is the establishment of Anthracite Coal Service.

No product at all comparable to coal has ever had created for it a similar organization, so far as my knowledge goes. The producer loads anthracite in the cars at the mines and ships it to thousands of retailers over a large territory. Many interests beyond the control of the producers have to do with its subsequent progress to ultimate conversion into useful heat. Highest refinements in technical processes of mining and preparation may be completely offset or nullified by improper handling, by faults in combustion appliances, or in the method of firing itself. In the past, what happened to the product after it reached the dealer's hands was something that the producers knew little about and for which they took scant responsibility.

The purpose of Anthracite Service was twofold. It was to give expert combustion engineering advice to the large users of anthracite and, secondly, it was to educate the retailer so that he would give high-class service and advice to the smallest consumer. Producers and retailers are now selling heat and service, rather than mere anthracite. In three or four years an organization numbering 70 men has been built up, with offices in a dozen cities from which the engineers of the service project their efforts into hundreds of communities. They, of course, continue to concentrate in those areas where the consumption is largest, but the aim is to have service follow every ton of coal, to the end that the user may get the utmost satisfaction out of it.

Many of the staff of the Anthracite Coal Service are able combustion engineers, competent to lay out the largest heating plants, to improve those in exist-

ence from the viewpoint of economy of operation, and to speak with authority in their profession and among architects and heating contractors. In addition to this effort, which was the initial step, the service has developed an educational system among the retailers and brought this to a point where nearly all the year 'round its domestic combustion engineering classes are being attended, week in and week out, by 500 students.

Retailers themselves would be the first to admit that in the past they had not handled and delivered the coal with an eye to presenting it in the most acceptable condition and most acceptable way, and that they had given only the most haphazard attention to their customers. They sold them the coal, and that was the end of it. Now, in all large communities and in many of the smaller ones, the anthracite user is assured of expert advice as to how to operate his heating plant, its state of efficiency, what size to use, how to overcome troubles, how to heat some room that was always chilly, and, what is perhaps the most important of all these things put together, the consumer feels that some one has an interest in his welfare, and that the coal man is not merely some one who sends outrageous bills, but is a man ready, able, and eager to serve; he is selling heat and service rather than mere anthracite. That such a revolution could be brought about in two or three years is, I contend, a great accomplishment.

As the joint activities of the industry expanded the necessity for a more effective organization of its members became more and more apparent. The Anthracite Conference, representative of all producers, became something more than a name for an emergency meeting. It became a working organization for given ends. Activities of the conference are divided into production and merchandising. The Production Committee deals with such matters as mining methods, preparation, sizing, inspection, labor, safety, etc. The Merchandising Committee maintains relations with the retailers, supervises research, studies traffic, market conditions and all matters having to do with the distribution of anthracite after it leaves the mines. The chairman and members of these committees give a tremendous amount of time and thought to policies and their execution. Many sub-committees composed of the industry's technicians and practical operating men investigate and report back upon special problems assigned them. This has the further benefit of enlisting the cooperation of the younger anthracite men in the gathering of data and study of problems from the standpoint of the industry as a whole, and the development of a broader viewpoint through the feeling that they are an essential

part of a united industry and not merely employees of a local concern.

Responses to a questionnaire sent out to 322 cities by the Anthracite Cooperative Association, gave three major reasons for the falling off of the anthracite demand, i. e., high price, interrupted supply during strikes and poor quality.

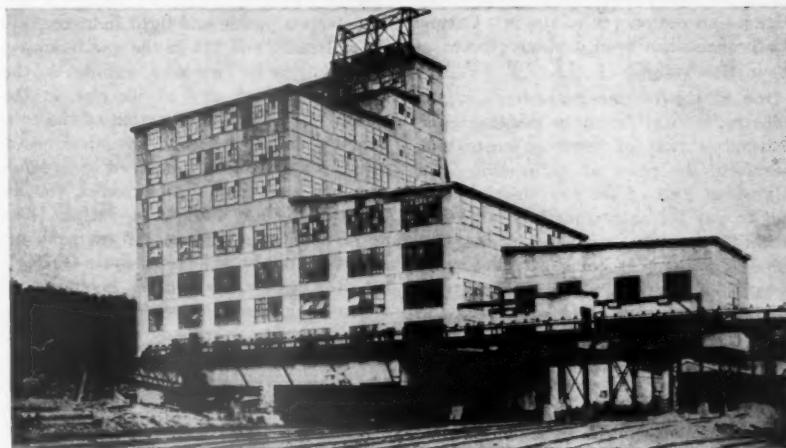
These problems were among the first attacked under the new organization of the conference.

The total amount of badly prepared anthracite shipped to market has been grossly exaggerated. Of thousands of cases of trouble in burning anthracite which have been investigated in the past few years by Anthracite Coal Service Engineers, only 5 percent have been found due to the quality of the coal, while 95 percent have been due to faulty firing methods or faulty combustion apparatus.

Combustion apparatus and firing methods constitute the court room and trial where final judgment is passed upon anthracite. This used to be a star chamber proceeding until Anthracite Service Engineers came in as "friends of the court."

Though not directly its own, a tremendous task confronts the industry in influencing makers of heating appliances, builders, architects, and others, in improved design, specification, construction, and testing of furnaces, heating equipment, chimneys, coal and ash handling devices, radiation and ventilation, automatic control and to inform owners and users as to what apparatus to select, what sizes to burn and how to burn it satisfactorily. Active cooperation along these lines has already caused considerable progress to be made toward the more satisfactory and efficient utilization of this great fuel. In teaching the use of cheap buckwheat sizes in old equipment and in magazine-feed and automatic stoking heaters, the industry has been unselfish, for much of this business has only been shifted from the larger sizes, but service has been rendered and competition met. Mechanical firing, control and de-ashing devices have made automatic anthracite combustion a reality rather than a hope.

The new organization of the conference also attacked the other phase of the difficulty, the matter of the quality of the product. Sizing of anthracite with a view to its most efficient use was made the subject of renewed study. Standard specifications for the various sizes were made more stringent. A most elaborate and extensive series of burning tests of various sizes in stock heaters and ranges had previously been made, and gave hope of economy in the possible reduction of number of commercial sizes, for it developed the fact that while perhaps less



pleasing to the customer's eye, there was no loss of heat value in reasonably increasing the spread of each size, say one-third. While the industry is aiming to increase heat value, the customers continue to buy largely on appearance of the coal; they make a visual inspection. This may be some indication of the quality but it is often misleading. That this is true the world over is indicated by Lord Melchett's recent comment:

"Coal buyers in England are cheerfully indifferent as to ash, moisture content and calorific power."

Our aim is to ship an efficient, closely-sized product as free from low combustible particles as commercially practicable. But about 20 percent low-grade carbon-carrying material accompanies all anthracite from mine to preparation plants, for anthracite seams contain varying percentages of "bone" running from 60 to 40 percent of carbon, and "slate" from 40 percent down. Anthracite standard specifications only permit in each commercial size extremely small percentages of each. To utilize only the purest particles from anthracite seams would result in prohibitive expense and prices and be as futile as the manufacture and use of any chemically pure product in a commercial process.

These limits are now lower than ever, as is also the limit of ash-content in steam sizes, and practically all anthracite marketed is well within such limits. They are lower than the bone content of the beef you buy of your butcher and for which you pay as much as you do for the meat. The insistence upon higher standards has been such that throughout the distributing end of the business and among consumers, I believe it is agreed without a dissenting voice that the industry is shipping a cleaner, better sized and particularly a more uniform product than ever in its history.

Aside from the urge of outside competition there is also a growing rivalry on

the part of the producing companies to get out the best possible product that brains and machinery can send to market.

The close inspection maintained by each company is supplemented by exacting joint inspections under conference auspices. This makes for uniformity of the whole industry's product and constitutes one of the best ways for meeting competition.

Realizing that even a good product, well serviced and merchandised, can not succeed unless it is in regular and constant supply, the industry has exerted itself to the utmost to improve its labor relations, and to avoid a recurrence of suspensions which are unanimously agreed to have been the most serious factor in turning the fuel buyer to substitutes for anthracite. These efforts have extended far beyond relations with labor itself. They have been carried to the people of the region in a way so impressive that in place of the antagonisms and misunderstandings of the past, we have in the anthracite region itself a public opinion which emphatically supports the view that there must never be another anthracite strike. It may be stated with confidence that the people of the anthracite region, including a large percentage of the mine workers themselves, realize this fact and appreciate that good working time is more essential to real earnings than an artificially high, inflated wage scale. Any sign of a suspension would be condemned by all; furthermore, the existing contract with labor provides for the unrestricted consideration in any year of modifications in the wage scale deemed necessary by either party and to final binding adjudication. Delays in entering into negotiations or deadlocks which have been responsible for most of the past suspensions, seem impossible under this unique provision now for the first time embodied in a contract. In the bringing about of a better understanding between the industry and the region in which it

exists the Anthracite Cooperative Association—an outgrowth of the Mt. Carmel Conference—has been a moving force of much importance.

One of the toughest problems of the industry, a vital factor in meeting competition, is that of reducing costs and, therefore, the price of anthracite. But only about half of the consumer's dollar goes to pay for such things as fall at all within the producer's sphere of influence. The cost problem is being attacked daily through efforts that would naturally be expected to reduce costs all along the line, but short-time operation brings such astonishing increase in annual costs, through idle investment and maintenance of collieries, that although the ingenuity of engineers and operators has made outstanding economies, yet the meager profits of normal operation have been wiped out for the industry as a whole by present prices and low production. That reduced costs of all factors between mines and consumer must come in the long run is undeniable.

In round figures it costs \$625 to produce 60 tons of large sizes and of this labor receives about \$450. To produce these sizes is the chief purpose of the industry, and the 40 percent salvaged in smaller sizes while sought for their clean, smokeless qualities, encounter fierce competition in an already glutted steam market. These small particles of anthracite, the result of breakage, stand as a challenge to inventive genius to raise their equal heat units to the dollar value of larger sizes. The salvage from the 40 tons of by-product small sizes is about \$110, making the net cost of the 60 tons of large sizes about \$515, or \$8.58 per ton. But they are now sold at the mines around this price, and the small margin may be astonishing to an incredulous public. The Coal Commission's investigation, however, disclosed for the 10-year period preceding 1923 a margin of only about 31 cents for the industry. "Doubting Thomases" in the United States Senate demanded the income tax returns of anthracite producers, and Secretary Mellon furnished them for the year 1924. These disclosed that 47 companies had an aggregate net income of \$28,000,000, while 92 had aggregate net losses of \$7,000,000, or a net for the industry of \$21,000,000; about 30 cents per ton on the 69,000,000 ton output for that year. But better working time, lower costs or better realization than obtained in the last year or two, are necessary to give any margin at all.

In the matter of wages the industry is now paying war-peak scale plus 10 percent. Its index is practically three times that of the 1913 basis, while the cost of living is only up 1½ times. The anthracite index of 294 compares with

233 in the manufacturing industry, 238 for electric power and light industry, 240 on railroads, and 213 in the gas industry. The anthracite workers group is the highest paid of any of its size in the world. To reduce the portion of the consumer's dollar absorbed by labor costs, either wages must be reduced or production per man must be increased, for its trend has been downward rather than upward in recent years. If the problem can be solved by the latter route through a better day's work and the ingenuity of mining engineers, it would be far more satisfactory to everybody concerned, but it is as true today as it was three years ago when Mr. Warriner stated at the opening of the conference that preceded the 1925-26 strike, that labor costs must be reduced. He stated then what many of us believe, that it is possible through cooperation greatly to reduce our labor costs without reducing wages, and it is only fair to say that we are today getting somewhat better results from labor than in the past. Much, however, is still to be desired in this direction and must be obtained. There are still, locally perhaps, wilful limitations of output and withholding of effort. There is still insistence upon the employment of some useless labor, and there is not always that kind of wholehearted cooperation with management that means the difference between a smoothly running machine and one that is hampered and halted all the time by indifference, insubordination and resistance to the installation of methods, improvements and mechanization aimed for economy.

The technicians and practical operating men in the industry are doing as outstanding work as any in the coal industries of the world. The engineer has been obliged to carry burdens imposed upon him by the trend toward shorter hours, reduced manual effort, higher wages and greater cost of materials. He has also had to offset the loss in production due to economies in consumption of fuel brought about by other engineers, an item said to amount to 200,000,000 tons of coal a year.

Central electric plants began to furnish power to small plants previously using coal under boilers; then huge central plants cut their use of coal to one-third or less. Similar economies were made on railroad locomotives and now they are going over to electricity. This chiefly affected bituminous consumption but increased its competition with anthracite steam sizes.

Economies in use and more efficient utilization of anthracite have also been brought about by necessities of consumers and by efforts of combustion engineers. These engineers are most insidious foes of increasing anthracite con-

sumption but they are on our own pay-roll to create satisfied customers; another contribution to combat competitive fuels.

Millions of dollars are being spent by the operators in improvements to existing plants and replacement of small inefficient units by up-to-date consolidated plants and in making a cleaner, more uniformly sized fuel; a product from every producer meeting one standard specification.

New methods of preparation are succeeding the highly developed jig just as it in the past superseded handpicking. Sand flotation and launder washing methods are largely used, and the foreign mixed-size jig is about to be tried; concentrating tables and washers are bringing the steam sizes down to an ash content hitherto thought impossible. Reduction in power costs and the complete electrification of collieries are coming on apace. The greatest engineering firms of the country are being called upon to bring new ideas into the industry.

The industry is giving serious attention to reduction in accidents to its workmen and in first aid treatment to those injured. Taken by 5-year periods from 1870 to date, continuous reductions in the number of fatalities have been made from the high figures of that year, until it is now only a quarter of that figure per 1,000 employe-days.

Three outstanding opportunities for salvaging waste in the anthracite industry await inventive genius, offering promise of fabulous reward for their accomplishment. Of the 16 billion tons estimated to remain in the ground the U. S. Coal Commission engineers class only 55 percent as recoverable, leaving 7½ billion tons of fuel with no apparent value unless and until created by the ingenuity of future generations. Anthracite broken from seams in the earth must be further broken to meet consumers' requirement that no pieces larger than 3½ in. in diameter be furnished for their use. After this breaking down only about 60 percent of the product remains on an 11/16-in. ring, 40 percent passing through in pea and the so-called "steam sizes." In addition to commercial sizes the small particles passing through 1/16-in. diameter mesh, while containing, weight for weight, the same number of heat units as the larger pieces, have not now any appreciable commercial value. The 40 percent in small sizes does not realize per ton a quarter that which the larger product brings, practically \$6.00 less per ton. In short, 3½ billion tons of the nine billion now thought recoverable will bring \$6.00 per ton less or 21 billion dollars less in the aggregate than it would if some means could be devised to prevent breakage to sizes below, say that of

a dime, or failing this to successfully patch the fragments together in equally acceptable form of fuel. So far the briquetting of these fragments has not met with much commercial success.

This huge potential salvage—running into billions of dollars—if applied as a reduction to the price of the larger sizes would amount to nearly \$2.50 a ton, practically solving anthracite's problem of a reasonable competitive price.

A further field for inventive genius lies in the gassification at the mines of small sizes of anthracite or of low-grade coal, bone and other carbon-carrying parts of anthracite seams, most of which is now discarded. The successful manufacture of such a gas, of sufficient heat value, and its piping to power plants and large industrial centers would eliminate the cost of transportation and create a tremendous value from salvage of potential heat units of low grade fuels and of dust, now valueless as such. Developments in gas producers and in technical processes of gas manufacture disclosed in international fuel conferences make this no idle dream.

Pulverized anthracite is also being used and experimented with, and gives further hope of utilization of low grade coal with more complete control during the combustion process.

In the mining of anthracite mechanization is going on apace. Where natural conditions, or artificial conditions due to former mining permit, new mining systems are being tried out, while undercutters, mechanical conveyors, and other mechanical substitutes for hand labor are in growing use. In short, the mining and preparation of anthracite by improved methods and mechanization is keeping abreast of the times.

Transportation to market, a matter beyond the control of the operator, represents about a quarter of the average domestic consumer's dollar. The anthracite freight rates were established years ago in the days of railroad control, on a basis very much higher than the rates paid on comparable bulk commodities. The rates are still on this higher basis. They are entirely out of line with bituminous rates and, so far as our western markets are concerned, they impose a burden that can hardly be overcome. They are, in the railroad man's own language, more than the traffic will bear. They may be said to belong in the same category as the Jacksonville wage scale and, through the pressure of economic laws, may happily accompany it into deserved oblivion. The railroads have transportation service to sell, and the value of the commodity handled should not rightfully enter into the charge therefor, save only to the extent of covering any demonstrated greater expense to the carrier, say, through loss or damage in

## FACTS ABOUT THE ANTHRACITE COAL INDUSTRY

- (1) Annual production amounts to approximately 69,000,000 tons.
- (2) Possible annual production is better than 90,000,000.
- (3) 14,000 retail dealers distribute the product. Their investment is estimated at above \$400,000,000.
- (4) The value of the coal lands, collieries and equipment in the anthracite industry estimated at \$990,000,000.
- (5) The industry employs 165,000 men.
- (6) Sales realization at mines amounts to about \$450,000,000 per year.
- (7) The industry has been beset with strikes on expiration of wage contracts, each raising the cost of production. Present contract for first time contains provision for adjustment of wages.
- (8) Its competitors are: low-volatile bituminous, coke, oil, gas and electricity.
- (9) It costs \$625 gross to produce 60 tons of large sizes. 40 tons of breakage salvaged in steam sizes returns \$110, making net cost \$515. Labor receives \$450 of gross.
- (10) In 1924 income tax returns disclosed 47 companies with net incomes, 92 with net losses, the average profit per ton being approximately 30c.
- (11) Wages in this industry are now war-peak scale, plus 10 percent, nearly three times those of 1913.
- (12) Anthracite workers group is highest paid in world for any industry of comparable size.
- (13) Transportation to market represents about one-fourth of average domestic consumer's dollar.
- (14) Taxes on anthracite have increased amazingly. In some instances the increase has been 700 percent within 20 years.
- (15) Anthracite, in the ground, is heavily taxed.
- (16) In addition it also is subject to a tonnage tax equivalent to 15 cents per ton of domestic sizes.
- (17) Taxes on anthracite, excluding Federal taxes, have increased from \$5,600,000 in 1923 to about \$28,000,000 at present time.
- (18) Special effort is being made to reduce costs, give public uniformly better coal better serviced, and to develop and foster a better spirit in labor matters and public relations. The industry is rapidly increasing its mechanization, and for the first time in its history has inaugurated an extensive campaign to bring to the consumer the real facts concerning this great industry.

transit. A car of anthracite and a car of bituminous hauled in the same train are charged disproportionate fares for equal service. Anthracite pays Pullman-car prices for day-coach service.

Anthracite carriers must look for a continuing shrinkage in tonnage moving west of Buffalo unless relief is provided in the form of substantially decreased rates. Rates under which a necessity will not freely move can not be applied in these days to a commodity such as anthracite that people can get along

without. The western consumer may prefer anthracite, but he can get along, he finds, with bituminous, coke, and oil, and he is not, in increasing numbers, going to pay \$4 or \$5 freight, plus the dealer's margin, for a commodity sold at the mines for \$8 or \$9.

A traffic bureau has recently been established by the industry with the purpose of ironing out inequalities and seeking reasonable adjustments in anthracite rates, predicated upon a rate and economic study that is now being made.

The general principle must in the end prevail that similar commodities, such as fuels, similarly handled, must all bear comparative transportation charges.

President Anderson, of the Consolidation Coal Company, writes in the *Atlantic Monthly* for December, in an outstanding paper on the coal problem, "Coal producers have to reach their markets—where the *delivered* price of coal awards the battle to the cheap—through an entanglement of freight rates wherein the most powerful of Government commissions holds the fate not of a mine or a company but of entire coal districts."

The Interstate Commerce Commission has that power, and has used that power to change the industrial map of the United States. It has for years condoned the wresting of the Pennsylvania anthracite fields from that advantageous location in respect to markets in which nature placed them and moved them, in effect, a couple of hundred miles off the New Jersey coast.

To me it seems impossible that the American people fully realize what tremendous power for industrial good or evil has lodged in this great governmental agency. At the request of the U. S. Coal Commission, the I. C. C. reviewed the anthracite freight rates, and after a rather sketchy investigation decided against a horizontal decrease in rates, although by a divided vote. Dissenting commissioners expressed the opinion that the rates were unreasonable and unjust, and also expressed the doubt that the Commission had had sufficient data and analysis before it. Further doubt was expressed that the Commission had sufficient funds to get the data. That although the Congress had given to the I. C. C. full power, and had charged it with the duty of maintaining reasonable rates, yet it had not appropriated sufficient money to permit full and complete investigation in such vital cases.

Aside from all these important items in reducing the cost and selling price of anthracite, we are endeavoring to save every nickel that can be cut from any of the various extraneous items making up the retail price of the coal. A strenuous effort is being made to repeal the anthracite tonnage tax amounting to about 15 cents on the domestic sizes, a tax on the ton of coal as it leaves the mines. Antagonism created by this tax in consuming states has been most harmful to the industry, and the healthy surplus in Pennsylvania's treasury does not seem to indicate any necessity for this discriminatory source of income. It is a double tax, for anthracite in the ground is also heavily taxed by municipalities in which it lies. This local tax burden has not been uniformly applied, the necessities of a community's budget being the determining factor, and in some cases as much as

700 percent increase has been imposed within 20 years. Taxes on the anthracite industry as a whole, excluding Federal income taxes, have increased from \$5,600,000 in 1913 to about \$28,000,000 at the present time.

Efforts are being made to reduce wasteful degradation of sizes all along the line down to delivery in the consumer's bin. Especially is this so as to the dealer's yard, for it is one of the important factors making up the dealer's costs, and if he can save 50 cents in degradation he can reduce his price accordingly. The retailer absorbing, perhaps, a quarter of the consumer's dollar, a joint survey is being undertaken to see what is the normal cost of retailing, what is the most economical type of yard, what a fair percentage of the total selling price the retail margin should be.

The transfer of anthracite to boats at tidewater piers has been immensely improved, and at every turn is found the disposition to put forth the utmost efforts to cut down costs with a view to reducing prices.

A promise of immediate price reduction can not be held forth, because at the present time the industry as a whole is not making any money. Realizations are low and costs, due to short working time, are high. The necessity for expensive intermittent storage of unwanted sizes adds to red figures.

But we have no doubt that costs and prices will be reduced by the sum total of all the cooperative efforts being made in this direction, and that the consumer will get the benefit in the end. We at least regard this as one of the necessary steps to be taken in meeting competition.

In the direction of sales effort, all of the producing companies are now using methods never dreamed of in the past. It must be remembered that in the old days many of us did not have to sell anthracite. We simply had to fill orders. And very often we were in the comfortable position of having more orders than we had coal. Today we find the best entrenched companies employing large forces of salesmen, advertising and using all of the time-tried and many new methods to sell their product. Some 45,000,000 tons of production is represented in a joint advertising campaign

that is reaching 6,000,000 newspaper readers every week, and by direct mail and billboards many more millions of consumers. In addition to this, a number of companies are conducting national campaigns involving the expenditure of hundreds of thousands of dollars. In the aggregate the industry is spending some \$2,000,000 in advertising, in addition to all of its other promotional activities. All this has come about within the past year or two. Anthracite has its flag nailed to the mast. It has something to

say for itself, and instead of its mute self-complacency of the past we find aggressive salesmanship and aggressive advertising.

Research work of an extremely practical nature has been undertaken by the industry acting as a whole. These activities are now being expanded under expert guidance. The objective is greater convenience in the burning of anthracite as represented by improved heating appliances, heat control, and ash-disposal devices. It will, of course, be admitted by all of us that these problems should have been attacked long ago. But automatic heating is a demand of new growth, and the industry is taking energetic steps to meet this demand. We believe that an anthracite fire provides the safest and most dependable method of heating a house. We believe that with the more general adoption of heat-control devices, and an easy method of handling and disposing of ashes, we will have for years to come the best heating method devised. There may be a time when centrally located plants—either steam, gas, or electricity—will heat the homes of this country. That time, however, is a long way off, and in the meanwhile it is the aspiration of anthracite to give the utmost of convenience and safety to the householder, to make it the best serviced fuel in the world.

In this effort we are inviting, and I am happy to say gaining, the assistance of thousands of retail coal dealers who must necessarily be the service men of the industry. In addition to the development of better devices we are carrying out in a number of communities some extremely interesting experiments in the supply of heat rather than coal. That is to say, groups of dealers are offering to heat houses for a fixed sum per year. The advantages of this are obvious. The householder does not have to make any additional investment for a new appliance. He simply signs a contract under which his house is to be satisfactorily heated, and can forget the whole business. I do not say that these experiments have proved anything as yet, but they are certainly indicative of the spirit with which the industry as a whole is attacking the problem of competition.

What I have said by no means includes all of the activities of the industry. It is enough, in my opinion, to show that it is going forward confidently and intelligently, that its problems are recognized, that it is grappling with these problems, that so far from being asleep it is very much awake, and that with the assured continuance of these efforts and their extension in any direction that may be necessary, we look forward with good reason to meeting successfully any competition now before us, or that is likely to be encountered.

# COAL'S RELATION to GOVERNMENT\*



## *Consolidations And The Creation Of Sales Agencies Urged—Cooperation Within The Industry A Vital Necessity—No Change In Trust Laws Necessary—Industry Will Solve Problems If Let Alone And Given Sufficient Time*

By J. D. FRANCIS †

AM asked to talk to you this afternoon about "Coal's Relation to Government." The subject is such a broad one that it may be approached from many points of view. I have been requested to discuss the subject from the particular viewpoints of what restrictions, if any, should the Government put on coal, the mining, sale, and distribution thereof, and of what the coal industry needs in the way of legislation, if anything, to assist in working out its problems.

Eliminating automobiles, coal is the source upon which we depend for about two-thirds of the heat, power, and energy generated and consumed in this country. Ten years ago it furnished about 90 percent of the heat, power, and energy. Its relative decline in importance has been due to the tremendous increase in the use of fuel oils, natural gas, expansion of by-product coke industry and its resultant by-products, and to the increased use of water power. While coal is now supplying about two-thirds of the heat, power, and energy consumed in this country, it has no monopoly in any of the fields in which it is used. Only by giving a maximum efficiency in service can it retain its present importance.

In speaking of coal from this standpoint, my remarks will be confined entirely to bituminous coal.

The coal industry is a diversified one. The first, of course, is production; then in their order sale, transportation, and distribution, each almost a separate business; as the growing of wheat, its transportation to the elevator, its distribution to the mills, its reduction to flour, and the delivery to and the conversion thereof into foods by the bakeries and the individual user. These functions are performed by the different persons and separate agencies engaged in these several industries. Yet the country is disposed to think of coal production, transportation, and delivery to the consumer as one business and one problem. And, with scant knowledge of the industry, holds the coal producer responsible for all errors of omission or commission.

I call attention to these facts merely to illustrate the inadequacy of public conception as to the many ramifications of the coal industry; and when I refer to the public, I include our representa-

tives in the Government as part of the public.

Let us analyze the situation and see what is the present situation in the coal industry. You have already heard an address on this subject this afternoon. We are producing in this country on an average of about 525,000,000 tons of bituminous coal per annum, which is sold and distributed throughout the Nation. Without this coal American industry and civilization could not have reached its present high standard.

It is to the interest of the country that the coal industry should be operated in an economical and efficient manner, and that the public should at all times be provided with an adequate supply of coal of satisfactory quality at prices reasonable to the public and compensatory to the producer. This statement may be made with equal accuracy and emphasis as to every other basic industry in the country, and the people engaged in the various industries, including the coal industry, are, I am sure, desirous of the same happy solution of this problem.

The question is: Can it be brought about without Government regulation, or a change of the present antitrust laws?

We know the coal business is overdeveloped. The coal producer is not to be blamed entirely for this overdevelopment. It is due to an effort on the part of the coal producer to furnish the public with an adequate supply of coal and to make a profit out of the business for himself. Moreover, it is not the only basic industry in the country that is overdeveloped; indeed, very few of these have escaped this condition in rather large measure.

We have in this country from 4,000 to 5,000 individuals and corporations engaged in the production of coal, operating between 7,000 and 8,000 active mines, exclusive of wagon mines, and, in my opinion, there are two basic causes for this overdevelopment:

*First:* The failure of the railroads, prior to 1923, to furnish the coal industry and the public adequate transportation. When the coal producers found they could work their mines only three days per week, sometimes less, in order to supply their trade and secure the new business they hoped to obtain, they opened new mines and equipped them for the production of coal. In 1923 the railroads overcame this period of strangled operation, and practically all the railroads in the United States began to furnish all their mines with 100 percent car supply. When the mines that had been working three days per week were given the opportunity to work their mines six days a week, naturally they were able to produce more coal than the country could possibly consume.

*Second:* Another cause of excessive development was the frequent and long strikes in the union coal fields. The industries of the Nation were not disposed to close down their business while the United Mine Workers were fighting with their employers, and the people of the country were not content to go without coal and be frozen into submission while these fights were in progress. Naturally, they demanded coal from the nonunion or open-shop fields. These districts developed rapidly and soon they were able to supply the Nation's needs while the union mines of the country were closed.

Without going into the merits of the controversies in the union fields, I do not think anyone will contend that the coal

\* Presented to the Thirty-first Annual Convention of The American Mining Congress, Washington, D. C.

† Vice President, The Island Creek Coal Co.



J. D. Francis

producers in the nonunion fields should be criticized or their operations penalized by legislation because they produced the coal that protected the country from large financial losses and great human suffering during the past 10 years. These long strikes forced many of the union fields to become nonunion, thus increasing the available supply of nonunion coal, until today the coal industry is predominantly nonunion.

The country as a whole has not suffered as a result of this overdevelopment of the coal industry. It has resulted in the Nation's having the cheapest fuel of all the nations of the world. It has also resulted in tremendous competition for markets. This always results when and where the supply greatly exceeds the demand.

The coal industry is further handicapped by the fact that the consumption of coal has not grown as the producers naturally expected. The industry is not primarily responsible for this. When coal was cheap and wages were on the 1913 basis, transportation charges were low, and large industrial consumers of coal did not have to treat their coal bill as seriously as they have since the period beginning with 1917. As a result of the war, wages trebled, not only at the mines but at the plants of the consumers; railroad rates doubled and trebled, and the delivered costs of coal naturally doubled and trebled. As a result, every substantial user of coal began to look for ways to decrease his fuel cost or to find a substitute fuel for coal. It is estimated that the efficiencies brought about in the past 10 years are now displacing approximately 150,000,000 tons of coal production per annum; that the use of fuel oil, natural gas, water power, and the savings of by-product ovens have displaced an additional 200,000,000 tons per annum.

While the costs of transportation have been greatly increased and costs of labor in the delivery of coal have mounted without seeming concern to the consumers, the cost at the mines, the accrual to the producer, has shrunk. Of the several agencies concerned in the coal industry, the coal producer is the sole agency that has not been permitted to share a general increase of the country's prosperity. On the contrary, the producers, who equipped themselves for increased production, have suffered either from lessened or stationary consumption of their product, resulting from increasing costs in the delivery of their product by other agencies, or from the consumers' turning to substitute fuels.

It can not be said that the use of substitutes or the increased efficiency in the use of coal has been to the detriment of the consumers of coal as a whole. In fact, but for these causes the public to-

day would be demanding more coal than the mines and man power available could produce, and probably more than our transportation systems could handle. Overdevelopment of the coal business has greatly increased the competition for the remaining markets and caused many mines to suspend and much labor to go from the coal industry into other lines of employment. This is a situation common to industry in general during and after periods of overdevelopment.

We still have in this country a productive capacity considerably in excess of the present demands or any demands that are likely to develop in the next several years. We have engaged in the industry a small percentage of excess labor, but the excess man power in the industry is small when compared with a few years ago, and is not great enough to be a material menace to the prosperity of the country or to the industry. In fact, most of the mines of the country, except those still suffering from strikes, have not had an excess of labor for the past few months.

When we speak of excess capacity, the figures used are usually on the basis of working all the mines full time 12 months out of the year. Those of us who are engaged in the industry know that as a practical matter this can not be done, and never will be done. To operate the mines 12 months out of the year would mean that large amounts of coal would have to be mined in the summer months, stored, rehandled, and reshipped for use in the winter. The interests of the Nation and the public in the coal supply are better served when the mines are retained for storage capacity. The cost of handling, storing, rehandling, and shipping this coal, together with the investment, carrying charges, and loss by fire and degradation would, in most cases, amount to nearly the original cost of the coal itself at the mines. Due to breakage and degradation, the grades desired could not be furnished. It is much better for the country as a whole to maintain an excess capacity and be able to have the coal mined and shipped as desired throughout the year, than it would be to reduce the capacity and go to much greater expense to store for winter use all the excess amount of coal not required in the summer.

The only danger the public encounters is that the industry is not now running upon a sufficiently profitable basis to continue to maintain this excess capacity. The shipments during recent months show the necessity for such excess capacity, when the production has ranged from 7,000,000 tons per week in July to over 12,000,000 tons per week in January. The demand for coal due to industrial activity varies greatly between winter and summer and between comparative

months of the same period of the year.

Some will charge immediately that to operate the mines on this basis is an economic blunder and a crime against labor, but no statute, legal or economic, can force the consuming public to buy coal when industry can not consume the same or buy in the summer months, regardless of the thermometer's suggestions, and no practical system can be devised whereby the output can be kept at an average throughout the year. It is true, of course, that fewer men are employed in the mines in summer months than in the winter months of peak production; but from the standpoint of the public and of the men employed in the industry, this has many advantages. Many of those who work in the mines in the winter are engaged in outdoor construction work, farming and other seasonal occupations in the summer. It is fortunate for them and for the public that they can go to the mines for employment during the winter months of peak demand for coal. This is another situation that is frequently distorted by some labor leaders and a few politicians, who for their own selfish purposes, or from ignorance of the situation, desire to place the coal business in the hands of the Government.

One of the arguments made as to why the Government should supervise the coal industry is that it is necessary that the Government do this to protect mine labor. *What are the facts?* Coal mine labor, from the standpoint of wage rates, has been, and is now, receiving wages equal to, and in most cases higher than, the average wages paid by industries in general. On page 43 is a schedule taken from the National Industrial Conference Board Treatise on "Wages in the United States," published May, 1926. Their reference No. 115:

Last year I submitted to, and filed with, the Interstate Commerce Commission a statement of wages, showing that both the rates and earnings for nonunion mine workers in West Virginia, Kentucky, Virginia, and Tennessee, on hourly, daily, weekly, or yearly basis, including all men regularly employed and engaged in and around the representative and typical mines in those four nonunion coal-producing states, were substantially more than the men engaged in the industries I have just mentioned. A similar statement showed that the men employed in the coal industry in those four southern states spent only 9 percent of their wages for rent, heat, water, and light, as compared with an average of 24 percent for the country as a whole.

This clearly demonstrates that it is not the wage earner in the coal industry who has suffered, and that the wage earner in this industry needs no more paternalistic protection from the Government than the

AVERAGE WAGES PAID PER HOUR FOR SKILLED AND UNSKILLED LABOR, BY INDUSTRIES, FROM OCTOBER 1, 1925, TO MARCH 31, 1926.

Industry	Skilled Labor Cents per hour	Unskilled Labor Cents per hour
Class I railroads.....	80.9	37.2
Iron and steel manufacturing .....	68.9	49.8
Agricultural implement manufacturing .....	64.6	47.7
Automobile manufacturing .....	69.2	51.8
Electrical apparatus manufacturing .....	65.7	47.0
Foundry and machine shop products .....	63.8	49.0
Foundries .....	64.7	51.0
Machines and machine tools .....	61.7	47.2
Heavy equipment .....	69.2	49.6
Hardware and small parts .....	58.8	45.2
Cotton manufacturing:		
North .....	48.9	37.7
South .....	35.2	25.3
Hosiery and Knit Goods manufacturing .....	61.7	37.7
Silk manufacturing .....	59.5	47.5
Woolen manufacturing .....	54.2	43.9
Leather tanning and finishing .....	56.6	49.1
Boots and shoe manufacturing .....	54.1	40.0
Chemical manufacturing .....	59.8	50.9
Paint and varnish manufacturing .....	59.0	46.8
Paper and wood pulp manufacturing .....	60.5	44.9
Paper products manufacturing .....	60.9	47.7
Printing and publishing:		
Book and job .....	87.5	46.9
Newspaper & periodical .....	95.6	48.2
Furniture manufacturing .....	61.8	43.5
Lumber manufacturing and mill work .....	60.8	38.0
Meat packing .....	55.8	45.1
Rubber manufacturing .....	74.6	53.6
Total .....	1,716.7	1,222.3
General Average .....	63.6	45.3

wage earners of all other industries of the country. We hear more about the wage earner of the union coal industry than in other industries, and this is because, as a writer in *Collier's* recently said:

"Labor in this industry has been more successfully dramatized by its leaders than in any other industry."

I do not want to be understood as not being in full sympathy with the interests of the wage earners in and around the coal mines. I feel that their best interests will be served by leaving them free from Government influence and regulation, with the right and opportunity to grow and develop as other free American citizens. They are all partners in our industry, and will benefit from any improvement therein.

To cite a concrete case of actual wage rates, in our company, the Island Creek Coal Company, in the year 1927, our men earned on the average of all the men employed, not including salaried men, 80.8 cents per hour. This compares with an average of 63.6 cents for skilled labor and 45.3 cents for unskilled labor in the 27 industries I have quoted, and equals the rates paid skilled railroad workers. Our rates of wages are the same now as they were in 1927, and while our rates are probably higher than some others, I believe the average wage paid in the nonunion coal mines today is

in excess of the average wages paid for similar work in other industries.

In 1927 our 3,000 employees earned an average of \$1,820.88 per year, and the average of 13,307 men in the southern coal fields upon whom I have reports for 1926 was \$5.62 per day, and while I would prefer to see higher wages paid and would like to see the industry in a position to pay higher wages, the situation is not such as to justify the Government's interfering in this industry on account of the wage situation.

Occasionally we see some writer referring to the industry as a "backward industry," from the standpoint of production, and especially in the use of machinery. As a whole this statement is without foundation in fact. The coal mines of this country that have had no interference from strikes and labor troubles are and have been producing coal in an efficient, economical manner. The coal-mining industry is quick to investigate or try every possible mechanical device to reduce the amount of manual labor, increase the production, and decrease the cost. By far the greater part of the tonnage produced in this country today comes from mines electrically equipped.

Last year I had occasion to investigate the percentage of coal mines in West Virginia, Kentucky, Virginia, and Tennessee using electrical cutting machines, motors, fans, and tipples operated by electricity. I found that 96 percent of the coal produced in these four states comes from mines that are thoroughly electrified. The use of mechanical loaders is growing as rapidly as they can be constructed and fitted to the individual conditions of the individual mines. In the year 1927 the mines of the Island Creek Coal Company produced 11.97 tons per day per man employed, working eight hours per day, and using 5 horsepower-hours for each man-hour. In England the average per day is 1 ton for each man employed.

I do not believe that any business man, whether he be in the coal business or any other business, believes that mines can make more progress from a physical and mechanical standpoint under Government control and regulation than they are making today. I do not mean that there is not much to be desired, but I believe the individual owners of the mines are, and have been, using the greatest effort that can be employed to reduce costs and increase efficiency.

Very little can be done in the immediate future to increase the uses and demands for coal other than to promote the adoption of better methods and the installation of improved devices of combustion, which give coal a better opportunity in its competition with other fuels. The next step in this effort to meet the

competition of fuel oil and other fuel substitutes is the reduction of cost. So much of this cost, including the railroad rates and handling and storage charges on coal at the point of consumption, is out of the control of the coal producer and seller that the only alternative of the producer is to work on the cost at the point of production. As I have already stated, he has been most efficient in reducing costs of production to enable him to meet competition.

If the railroads could be persuaded that it is to their advantage to haul more coal at a less rate it would stimulate to some extent the general use of coal, but we have to remember that fuel oil, after all, is a by-product and must and will be sold in connection with the production and sale of gasoline; that under these circumstances it can, and often will, be sold below its real value.

Therefore, the real problem facing the coal producer is to arrive at some method of distribution whereby production of coal can be based on the demands of the country so that the coal may be sold at a price that will allow the mines to operate at a fair profit, after paying reasonable wages to the men engaged in the industry. No one in this country objects to this being done. The consumer of coal, as a rule, is not trying to buy an article at less than a fair price, but, like any other consumer, he will accept a bargain when offered.

The coal industry has concentrated on solving its labor difficulties, increasing the output from its individual mines, installing new machinery, and reducing its cost of production.

It is the desire of every producer to operate his mines every day and give his men full employment. Each company or small group of companies will be found selling their own coal in competition with every other producer. The producer constantly urges the sales department, whether it be an individual sales department or a jobber, to furnish him with orders for full running time. With all the individual mines attempting to run as nearly full time as possible, the supply greatly exceeds the demand, and every purchaser of fuel in this country is being offered his full requirements of coal by dozens of different companies from as many different mines and districts.

As there is usually a surplus of standard quality coal for every use, the argument that every salesman finally is forced to resort to is price. The price is not based primarily upon what the coal is worth to the seller or buyer, but on the seller's fear that many competitors may make a lower price.

The real problem confronting the coal industry today is: How can the producer and the seller of coal so adjust their

business as to remedy the situation just described without largely destroying the industry or injuring the public?

The suggestions generally made are: Control by a Government commission; amendments to the antitrust laws to permit agreements to restrict production and fix prices; consolidations or mergers; and formation of large independent selling agencies.

We shall briefly consider each of these suggestions.

What does the proposal of Government control offer the industry in the way of regulation, and what do the bills to regulate the coal industry attempt to exact from the industry as the price for these proposals?

Most of the legislation to regulate the coal industry provides that the producers may get together in groups or districts, based on geographic location; sell their coal individually or through common sales agencies, or at prices fixed by a Government commission. In consideration of this, most of the bills would require, among other things, that a Federal coal commission be established, with the authority and duty to fix minimum or maximum prices on coal from each district, establish maximum and minimum wages and working conditions, and require the producers to conform to same; designate the markets in which coal from each district can be sold, parcel off the country in zones of consumption as well as districts for production; and provide that no new mines shall be developed and no cars furnished by the railroads to new mines unless they operate under the rules and regulations of the coal commission.

To my mind, this is entirely too great a price to pay.

If the coal industry does not elect to pay this price and decides to go on managing its own affairs, the same as other citizens not subject to Government regulation, what can the industry do for itself, if anything, without amendments to the so-called antitrust laws, including the Sherman and Clayton Acts?

These laws forbid the sellers of coal and other commodities to form monopolies, to combine to agree on prices, or limit production in a way that will interfere with the free movement of any commodity in interstate commerce.

The courts have held that fixing prices by agreement so as to control a substantial part of the output of an industry, whether the price be fair or unfair, reasonable or unreasonable, is in itself unlawful. It was held, however, in the Maple Flooring and Cement Cases, that associations can be formed for the purpose of collecting and disseminating necessary and desirable information in regard to conditions affecting the various industries, but that these associations can not be used to conceal price agreements.

These laws forbid certain types of mergers, but they do not forbid consolidation of properties through actual sale of the physical properties of one company to another company; neither do they forbid the formation of large sales companies to sell the output of individual mines, so long as they do not create a monopoly.

The coal operators in this country are a hard-headed, common-sense, business-like set of men. They realize more keenly than does anyone else the difficulties under which the industry is now laboring. For years they have sought ways and means of correcting the evils from which they suffer and for establishing the industry on a permanent basis, a basis not subject to just criticism by anyone. To these questions they have devoted the best thought of minds not inferior to those engaged in other industries, and in the light of long experience it seems to me that it goes without saying that they would be the first to grasp and adopt any suggested governmental action which they believe would accomplish these purposes. It is significant that, practically without dissent, they agreed that no legislation can be of any particular value to them or to the consumer of coal. Slowly but nevertheless surely they have developed and brought to light the facts responsible for their troubles. In time the remedy will be found, but it will be found by the people who know the coal industry and not by politicians or by professional reformers.

I do not believe an amendment to the antitrust laws to permit price agreements by sellers is either necessary or desirable. We are not justified in believing that 4,000 or 5,000 producers of any commodity can or will get together and agree on fair and reasonable prices and stick to them, even though there were no antitrust laws. The desire of each to run his own business in his own way would, of itself, prevent such agreements. Furthermore, the public is not going to allow amendments to the antitrust laws permitting price agreements by individuals, groups, or associations, without exacting terms and conditions as a price for these amendments that would take away most, if not all, of the benefits that will be derived as a result of such agreements. Any industry which gets exemption from the antitrust laws is going to have to accept Government control on such terms and conditions as may be imposed by Congress from time to time. The country is justified in demanding that no group of individuals or corporations be allowed to monopolize and arbitrarily fix prices on the necessities of life. Monopolies are repugnant to the very spirit of our form of government. Our country and its industries have grown and developed under open, competitive condi-

tions, and, within the limits of reason, these conditions should continue.

No one, however, believes in a senseless, ruthless, and destructive competition. Such competition has occurred from time to time in various industries in this country. When situations reach an extreme, they usually cure themselves. The steel industry and other industries have gone through just such situations as the coal industry is now experiencing. These conditions force bankers and leaders in the industry to get together and, under existing laws, to put their houses in order. Given sufficient time, the coal industry will work out its own salvation.

There are two ways in which this can be done.

The first is by actual mergers of physical properties into groups sufficiently large to eliminate the present ruthless competition and substitute a fair and healthy competition between larger producers. There are many difficulties in bringing about physical mergers of a large number of producing units. To do this within the industry and without a large amount of banking assistance, individuals must be willing to submerge their own identities and become a part of a large organization. This is a difficult thing for business men to do.

The recent attempts at a large merger in the West Virginia smokeless fields was along these lines. We were unsuccessful in this attempt, not because the proposition did not have great merit and would not have proven a financial success to the persons entering into it—not because it would not have fully complied with the law, for it would have, and would have been a benefit to the public—but because a few of the individual owners of the properties, due to fears and distrust of each other, would not agree to sell their properties to the proposed new company and risk a management other than their own. This does not mean that this proposition is permanently dead in the smokeless fields, or that a similar proposition can not be perfected in any of the bituminous producing fields. The experience in this attempted merger shows that to consummate a proposition of this kind it is necessary for the persons and corporations agreeing thereto to be willing to submerge their own and their individual company's identity for the consideration of the general benefits to be derived therefrom. Under existing laws, I think there is no limit placed on the size of a company that may be formed to acquire properties in this manner, so long as it does not become a monopoly controlling or having the power to control interstate commerce.

The Supreme Court has held that the Steel Corporation, controlling about 50 percent of the output of that industry, was not such a monopoly, and a company

controlling 100,000,000 tons or even 150,000,000 tons of coal production would not, to my mind, violate any existing laws on account of its size.

Working out mergers of this type will require a considerable period of time, but in the meantime, under existing laws, if the industry desires, there can be brought about a consolidation of sales that will greatly lessen the present destructive competition.

Nearly 90 percent of the total production of bituminous coal of the United States is east of the Mississippi River. If there were formed in this territory 10 or 12 large sales companies that could induce the operators producing the coal to allow them to sell their output, so that each sales company would have from 25 to 50 or 60 million tons of coal to sell per annum, it would result immediately in a reduction in the competition, without any agreements between the sales agencies. If responsible and trained men were placed at the heads of each organization (and many such men can be obtained from the present sales organizations of the individual coal companies), making the selling agencies responsible to the producers for the selling price and to the public for the service rendered, they could and would increase the selling price of coal to a point where the producer in each district could get a fair price for his product and be enabled to pay continuously a fair wage, and the public would be given coal of a uniform quality at a fair price. There would be enough competition between the various sales agencies to prevent prices from being raised unduly or the public from being "gouged."

Such selling agencies should be large enough to properly advertise the product being sold, have a force of trained men engaged in selling and demonstration, and sell their coal to much greater advantage than it is at present being sold by the thousands of different companies and agencies selling independently. Such selling agencies could eliminate the dumping of coal by its own clients at prices under the cost of production.

For example, let us assume that we have one selling agency for central Pennsylvania, a second for western Pennsylvania, a third for Maryland and northern West Virginia, a fourth for southern West Virginia and eastern Kentucky, a fifth for Virginia and Tennessee, a sixth for Alabama, a seventh for Ohio, an eighth for Indiana and western Kentucky, and a ninth and tenth for Illinois.

Each of these district agencies would be actively competing with two or three (in some cases four or five) other district agencies. Each would be selling different grades of coal for different mines at different prices. The consuming public would have the greatest pro-

tection, in that if they did not get the proper coal and service from one district it could be obtained from another.

Such sales agencies should not be patterned after the foreign cartels. They would not undertake the sale of coal from mines having an undesirable product, excessive cost, or unsatisfactory equipment for preparation. Owners of several mines would soon find it advisable to close the poorest mines in order to operate on a satisfactory basis.

How could these sales companies be formed, and what benefit would they be to the producer? To be successful such a selling company should be formed in each territory by the principal, outstanding men engaged in the industry in that territory. The sales company would have to have sufficient capital upon which to operate and extend reasonable credits. Such sales company could not be made a basis for subterfuge for price agreements, as this would violate the law. It would necessarily have to be in the hands of men in whom the producers in the various districts have the greatest confidence, because the first thing the producer employing such a sales agency will desire to know is, "Will the agency give me and my company a square deal? Will they sell my coal to the very best advantage, and, considering my comparative quality and preparation, will they ship my coal to consumers who will give me as good relative prices, quality considered, as that received by my neighbor? Will they, so far as possible, give me an equal opportunity to run my mines on the same relative basis as my neighbor runs his mines?"

If the producers of any given district can be satisfied that a sales company so formed will carry out honestly and fairly the various things just suggested, it will be possible to organize and successfully operate such a sales company. Many such sales companies are today being operated on a small scale. There is nothing new in the plan other than to extend the size and scope of activities of the central sales companies.

It is evident that in the beginning it would be impossible to get all of the producers of any district to enter into a plan of this kind. There are many Doubting Thomases in the industry who would wait to be shown the benefits to be derived before they would discard their individual sales companies or agencies and go into such a new sales company.

But once such a large agency is started with a substantial part of the tonnage from each district, and the neighboring producers find that the large company is giving the individual producer fair and satisfactory service, including substantially equal running time, and returning to the producers having the same grades of coal substantially the same prices, and

those having better grades or poorer grades of coal, a relatively equal price, based upon the value of the product shipped; that the large sales company is honestly and efficiently managed; and find that the coals are being sold under their own true trade names, where such trade names exist, and that the producers represented by such sales companies are not losing their identities in the markets, the other producers will gladly come into such an arrangement, because they can not afford to remain on the outside.

While I should prefer to see actual consolidation of properties, there are advantages in sales agencies of this kind over an actual consolidation, in that they require little or no financing. Also, the individual producers will be left in complete ownership and control of their producing properties without any dislocation in the industry, and each man will have the advantages growing out of the individual management and operation of his own properties. He will still be in position to accept or reject the business offered him by the sales company if the price and terms are not satisfactory to him. Some of the mines and companies would undoubtedly be required to curtail their output, but the advantages growing out of such an arrangement would be great enough to compensate for any reduction in running time that might be suffered by any individual producer. No individual company would be permitted to direct the sales company to dump their coal on the market, regardless of value. Consignment shipment would not be permitted. The judgment of the sales company would be final as to price policy. Prices would have to be made to meet the competition of neighboring districts, fuel oil, gas, hydroelectric power, and other sources of heat and energy.

Such a plan of sales would probably result in a somewhat higher price for coal to the industrial consumer who is today getting his coal for less than cost of production. Most of these users would not object to paying a fair, reasonable price for their coal. It also should result in some reduction in the price paid by the domestic and other small users who at this time are paying more for their fuel in proportion than the large consumer.

Such a plan can be worked out without changing any of our anti-trust laws. These laws have been, and still are, of great value to our country, and the advocates of amendments to these laws overlook in their enthusiasm for better and more desirable marketing arrangements the fact that they are protection against conspiracies on the part of other business people to injure their business and conspiracies on the part of unscrupulous labor dealers who would, but for these laws, (Continued on page 55)

# The CASE for COAL\*



## An Analysis Of The Present Bituminous Coal Situation And A Plea For Such Cooperative Effort As Will Enable The Industry To Discern Its Weaknesses, Control Its Individualism, And Employ Its Wisdom, Skill And Fairness—With Such Cooperation Coal May Soon Find Relief From Its Present Condition

By H. E. WILLARD †

prime necessity of all industry. That may at first thought seem to be a strong statement, but let us carefully inventory the material things we have in which coal has had a part in giving us, and we will soon discover that coal is the very heart, so to speak, of our industrial organization and life. It is the warmth of the life stream that flows through the arteries of industry and of trade.

We find on that inventory electricity from the hydroelectric plants, because coal was used in the making of the machinery and the towers that carry the wires through the country.

We find natural gas on that inventory, and all petroleum products, because coal was used in the making of the pipes and the machinery through which it reaches us.

We will also find agricultural products, including cotton, sugar, and meats, on

that inventory, because coal has been the large means of preparing and transporting these things to our doors.

We will even find that the potato on the table of the farmer reached there by the aid of the plow and hoe, in which coal was used to manufacture.

Then let us try to inventory the things in which coal has had no part in reaching us, and see how few of the necessities of life can be placed on that inventory.

The bituminous coal industry of this country has not shared in the wave of prosperity enjoyed by other industries directly or indirectly dependent upon it.

The first statistics which we have in our country of the production of coal began in 1820, the census period at that time. Coming down to the opening of the Great War in Europe, we find that so great has been the demand for coal that in each 10-year period the production of coal in the United States was doubled. This rapid increase in the production of coal to meet the growing needs of the industries of our country, including the railroads, compelled the coal men to be the advance agent of that prosperity. They were the hardy, courageous pioneers of all industry. They sought out and prospected our seams of coal.

The steel mill and the factory may select a site with regard to the accessibility of raw material, the supply of labor and the market for the product, but the coal mine must go to the coal seam, regardless of the supply of labor or the location of the market.

The mill and the factory acquire raw material with which to fill orders, but the mine must first acquire sufficient coal for the expected life of the mine.

The mill and the factory are each similar to other competing units, and each produces a similar product to that of a competing unit, but there is a great difference between the character of coal mines and the product of mines.

The mill or factory may be removed with little loss or no loss in raw material to meet changing conditions, but the mine can not be removed without a heavy or total loss.

The mill or factory can be suspended at much less expense than a mine.

The mill and factory are easily ventilated, and are comparatively free from the destructive elements of water and gas, but the mine is costly in ventilation and drainage, and there is an increased hazard from explosion and from water and gas at many mines.



H. E. Willard

**I**N approaching a discussion on this subject, it might be well for us to give a passing glance at post-war conditions of the industry to refresh our memories somewhat, and bring us down to the present time.

During the war period great demands were made upon the coal industry as a whole, not only by our own Government but those of the Allies of the Government, for large production and further increases of the facilities. So great had become these facilities that after the period of the war had passed it was found that the mines of the United States had been brought to a production basis where, temporarily at least, only a portion could operate. Still further to aggravate this condition was the fact that the railroads had been able to supply what the coal operator had rarely seen before—a 100 percent supply of cars. His industry had been built up and accommodated heretofore (except in rare instances) by an inadequate car supply. This, added to the enormous increase of production facilities, aided in bringing about a condition in the bituminous coal industry which we now face.

Having arrived at this point, we must give consideration to another element. During the past few years the great coal-mining states of West Virginia, Pennsylvania, and Ohio have, with the support of the public, placed themselves in position through the rearranging of their labor conditions where strikes and lock-outs will no longer obtain. This has not been accomplished by a refusal of the bituminous coal producers to pay fair and reasonable wages to their employees.

This, then, in a general way, is the situation which confronts the bituminous coal industry. During the last few years, particularly in the last five years, many mining companies engaged in the bituminous coal industry have either gone into bankruptcy or abandoned their properties or been forced by other reasons to cease their operations. In fact, the industry is now engaging the careful consideration of our financiers, those in our Government whose duties naturally look to the care and the fostering of industry, and a large percentage—a very large percentage—of the public as well.

Bituminous coal has been and always will be, so long as the supply lasts, the

\* Presented to the Thirty-first Annual Convention of The American Mining Congress, Washington, D. C.

† Secretary, United States Coal Company.

The coal producers, the hardy pioneers of all industry, in their search for coal have penetrated the wilderness, risked their capital, created new communities, and brought to such communities such cultural advantages as were possible, in order that the people of this country might have coal and that the labor employed there might have all reasonable advantages. These pioneers invaded widely scattered territories wherever coal was to be found, which resulted in a great number of ownerships, with many conflicting interests. By reason of this it is natural that certain producers with more favorable conditions are more strongly entrenched in the markets than their less fortunate competitors, and during these long years of keen competition it is only natural that individualism has taken a strong hold and that efforts were made to capitalize those advantages. This individualism, coupled with the unwillingness of other producers to recognize their disadvantages, has frequently blocked efforts to put the industry on a higher plane. The fact that the coal industry, or, rather, coal, is a prime necessity has subjected this industry to more governmental restrictions than any other industry, and this fact has discouraged constructive effort.

Our railroads have prospered in recent years with governmental encouragement and assistance, and other industries have prospered because of a greater freedom of action and relief from retarding restrictions.

The coal industry must dispose of its surplus in competition with coal from other nations, the same as the farmer must dispose of his surpluses in competition with other nations. The tariff has been inoperative and of no effect, as applied to coal.

The fostering care of the Government for the success of every line of industrial effort in our country has not been applied in equal measure of assistance to the coal industry. The coal industry is very sensitive to change of conditions, and highly competitive. It operates on the 48-hour week. Its productive capacity has to meet the maximum demand and, unlike mill and factory, can not operate double or triple shift to meet extraordinary demands. Therefore, during periods of lower demand, costs rise and prices decline. When costs exceed the price the weaker units are forced to suspend or abandon their mines, and much coal in the ground is forever lost to the owner and to posterity.

The mill and the factory may continue production during periods of low demand and store the product for shipment on demand, but the mine has no such alternative, because the product must go from the mine direct to the railroad cars, and when the orders are stopped or the

cars are stopped, the mine must also stop. Increasing mergers of industrial and transportation units have brought syndicate buying, with which the coal industry has not been prepared to cope. The producers, in their struggle for existence, have had to accept prices which were unremunerative, inadequate to maintain the coal industry on a sound basis, and have frequently led to bankruptcy.

The railroad, the mill, and the factory have a degree of permanency not found in the mine, which is gradually depleted to exhaustion. These differences between mines and other enterprises, together with the absence of better organization and cooperation within the industry, have gradually increased the difficulty of financing of coal operations. The bituminous coal industry, not having shared in the general prosperity enjoyed by other industries directly or indirectly dependent on it, is now in an unprofitable and unhappy state.

There must be reasons for this unfortunate condition.

There are reasons, and we have only to look at our transportation systems, with their maximum prosperity; at our steel industry, with its great prosperity and high example of organization; at our public utilities—to discover and proclaim that one of these reasons is the lack of proper organization and cooperation within the industry, and the lack of proper encouragement and assistance from our Government, the failure of the Government to give the same fostering care to the coal industry that it so generously and continually exercises for all these other great industries.

Considering other industries, we find unification of the small competing units has been the order of the day, and unification has brought better organization and better cooperation. Some may wonder why the coal industry, with all its importance to our industrial life, has been the laggard, so to speak, and allowed itself to drift into its present situation, facing a survival of the fittest. I have already explained to you some of the reasons.

In looking at the situation as presented so far, it would seem to be one which should appear on the surface to be almost without a remedy, but to this I can not agree. During many years of association with the bituminous coal industry and the production of bituminous coal, I have learned to know that the men who, by and large, have been at the forefront of this industry were men of courage, honor, and integrity. I believe, as a class, they still occupy that position.

There is among them no lack of engineering ability, no lack of technique. We have been the leaders of the world in those respects, in the production of coal. There are in the coal industry strong

men, men of large capability. They must and will come to the front. The case of the bituminous coal industry must, through the efforts of all engaged in it, in the definite and concrete forms, be made to assume its rightful place and position. We should demand, and I have no doubt we shall receive, that favorable consideration from the Government which has been so freely bestowed upon others and withheld from us.

In attaining these things we should bear in mind that organization of a definite and concrete form must be had. The bituminous coal man must begin to think in terms of the industry outside of his own immediate surroundings. In this effort I feel confident we shall have the support of the public. I am also convinced that with proper procedure along lines of sound industrial progress we shall receive the support of the Government. We have not as yet called your attention to the conservation of the resources of our bituminous coal seams. Their potential wealth for the health, the happiness, and prosperity of this country are beyond calculation, and to waste and destroy them is unthinkable.

It is the duty of the men engaged in this great industry to show to the Nation that, as stewards of this industry, we are anxious for its proper conservation.

One further fact at this time I wish to direct to your attention. We hear from time to time of individuals who have amassed great wealth, and during all of the time that the bituminous industry in this country has been growing, expanding, the steel industry has produced enormous wealth for individuals and associations, public utilities have lent their aid to the creation of enormous aggregations of wealth, the manufacturers of farm machinery have produced men of enormous wealth, the automobiles and the railroads and the oil industries have all produced large masses of individual wealth, but I know of no single individual ever engaged in the bituminous coal industry that has acquired that distinction of enormous wealth derived from that industry.

Is it not now the appropriate time for the bituminous industry and the men engaged in it to demand and receive its reasonable and proper share in the general prosperity? The vast majority of bituminous coal operators wish and desire to pay the labor performed. The industry must stabilize itself to protect its depletion and depreciation, and must continually seek through engineering methods and the employment of proper machinery, a proper amount of conservation. And it must also provide necessary reserves for the replacement of the plants that are now being exhausted.

I come to you with no specific recommendation as (Continued on page 52)

WHEN a speaker is called upon to appear before a group who have the habit of digging into their subjects as deeply as do mine operators and mining engineers, and when, in addition, he is asked to discuss a problem as profound as that of the relation of mechanization to human progress, the speaker so challenged can do no less than attempt, for the benefit of his audience, to do the best piece of philosophical mining that lies within his powers.

Let us begin, therefore, in very formal fashion with two definitions. First, as to human progress—the man who said he didn't know where he was going, but was on his way, can not be said with certainty to have been progressing. The idea of true human progress can be associated only with a definite human objective. Here I am afraid that we begin to run at once into the theological field. However, I am not going to set forth my own theological beliefs. One engineer has already been elected to the presidency of the United States and, while my own political ambitions fail to run today beyond a possible position as road supervisor, I do not wish to deprive the country of the chance to elect another engineer as President any time that it really insists on doing so. In any case, it is sufficient for me to say that I made my personal confession of faith not long ago to a very dear old minister, who said he wasn't satisfied to accept my contributions unless I would also become a regular member of his congregation. I said that I doubted whether I could qualify for such membership, but after hearing my confession he told me that, while my views were tolerably liberal, he could still make me a deacon in his church if I would take the job.

This, however, is apart from the question before us, and is interjected solely for the purpose of putting myself finally and permanently on record for political purposes. What I am really concerned with is your theology and the theology of all of us who are, or will be, the agents and/or, as the lawyers say, the victims of human progress. As to this theology I suspect you are a mixed crowd. Some



## MECHANIZATION and HUMAN PROGRESS\*

By COL. M. C. RORTY †



*Mechanization Is Not Human Progress, But Is So Closely Knit With It As To Be Inseparable—An Increasing Mechanization Of Our Industries Is Inevitable—It Is Raising Higher And Building More Firmly Those Economic Foundations Upon Which Our Progress Rests*

of you probably look upon this life as, in the main, a preparation for a life hereafter, while others look upon our present existence as an end in itself. But I think we can all agree that we can adequately define human progress, for our present needs, by saying that it should represent a continuing approach to the maximum of dignity and beauty and happiness in this life that can be attained without sacrifice of our chances for a life hereafter. It is, therefore, in this sense that I shall speak of human progress.

Now, as to mechanization—I suppose that the first savage, who abandoned the attempt to run a rabbit down on foot and kill him by throwing a stone, was resorting to mechanization; and I am not sure that mechanization, as we must think of it, does not include the simplest specialization of human effort—the very

beginnings of industrial organization and of barter and trade—as when the first stoner of rabbits traded part of his rabbit skins for a portion of the catch of the first spearer of fish. So I shall speak of mechanization not only in the sense of the application of tools to the accomplishment of human purposes but also in terms of that functionalization of human effort which normally, and almost necessarily, accompanies the use of specialized and efficient tools.

With these definitions once established, we can mine a little further into our subject. If we are to have dignity and

beauty and happiness in human life, it is very difficult, if not impossible, to conceive that these elements can exist, or be attained, unless we have first an adequate economic background—a proper provision of food, shelter, and the other bare necessities of human existence. And the more thoroughly we study this question, the more firmly we must become convinced that only through the mechanization and functionalization of human effort can an adequate supply of these bare essentials be obtained without such hours of labor as will leave us no leisure for the refinements of living. Certainly this is true in the temperate regions of the earth, where our civilization has its principal development, and in such temperate zones we must recognize that, if mechanization and functionalization are not themselves the tree of human progress, they at least are the sap of that tree. Furthermore, even if we feel that the young tree of our human progress has not yet borne its full and adequate fruit, we surely can not hope to secure a more ample and perfect harvest by girdling the tree and stopping the flow of sap.

Mechanization is not human progress, but it has in the past been knit so closely with human progress that the two are practically inseparable. If we are to argue against mechanization, we should be wholly logical and seek to determine the point at which mechanization should end. Should we abandon the tractor and multiple plow and revert to the old horse-drawn single steel plow? Or would that still be too great a degree of mechanization, and should we not revert a further step to the crotched-stick plow drawn by oxen, or by man power only? And

\* Presented to Thirty-first Annual Convention of The American Mining Congress.

† Vice President, International Telephone and Telegraph Corporation.

should we not then continue the same line of reasoning, step by step, until we arrive finally at the conclusion that each man should become his own farmer and should till the soil by digging with his naked hands?

When the question is thus approached, not even the most rabid opponent of the mechanization and functionalization of human effort will contend that mechanization in itself is an evil, or that the steady progress of mechanization should be checked—and the argument will resolve itself, as it should, into a discussion of the manner in which the occasional evil effects of mechanization should be tempered or obviated.

At this point, we may be able to appreciate more fully a special negative function of mechanization, which is perhaps quite as important from the historical standpoint as its positive aspects. We may search history as we will, we may delve to the limit of our ability into the nonwritten records of the prehistoric past, and we shall find not one single instance where a tribe or race or nation has ever attained a given level of skill in the making and use of tools, and has fallen back from that level. No tribe has ever advanced from stone tools to tools of bronze and fallen back again to the age of stone; no people has ever learned the art of iron making and afterward lost that art. The civilization of Greece advanced far beyond the skill of the Greek people in the use of tools, but when the Greek civilization decayed the tools of Greece remained in use unchanged. Rome fell, but during the ensuing Dark Ages, when the other elements of civilization had so vanished from Europe that the history of those days can hardly be written, not one of the tools of Rome was lost to human use and knowledge.

Mechanization may not, therefore, be civilization, but at least it is that element in civilization which stands fast when all other elements are disrupted and dispersed; and it is the firm foundation from which, when civilizations fall, they may rise again.

But I need take no more of your time in setting forth the uses of mechanization and its contributions to human progress. We might as well attempt to halt the lavas of Etna as to condemn mechanization and seek to check its steady advance. An increasing measure of mechanization is one of those inevitable conditions of life to which we all must adjust ourselves. Furthermore, there is, today, hardly a trained economist or an intelligent workman or labor leader who does not recognize that the mechanization of industry has been directly responsible for that increase in real wages which, in spite of occasional halts and

"WE might as well attempt to halt the lavas of Etna, as to condemn mechanization and seek to check its steady advance. An increasing measure of mechanization is one of those inevitable conditions of life to which we all must adjust ourselves. \* \* \* There is hardly a trained economist, or an intelligent workman or labor leader, who does not recognize that the mechanization of industry has been directly responsible for that increase in real wages which, in spite of occasional halts and irregularities, has doubled and trebled the income of the ordinary worker during a comparatively short span of years."

irregularities, has doubled and trebled the income of the ordinary worker during a comparatively short span of years. I might go a step further by venturing the suggestion that you, as mine operators, may possibly avoid certain complications in your arguments with the labor organizations with which you have to deal, if you will begin each discussion on the assumption that an increasing mechanization of mining operations is inevitable and that the only problem is to temper the effects of such changes upon the mine workers and to establish an equitable distribution of any margin of increased earnings, above the bankruptcy line, that may result from the increased output.

If, then, we admit that mechanization is bound to continue and increase, and is, on the whole, a steady contributor to true human progress, our entire concern, as has been indicated before, is with the general changes that it is bringing about in our lives and with the specific evil effects that it occasionally produces.

To discuss the general changes resulting from mechanization would be to write the whole history of our modern civilization. These changes are so continuous, and often so indirect, that we frequently fail to appreciate them. I might quote from Herbert Hoover's essay on the "Right to Fish" to show the connection between the automobile and the time between bites. Or I might call your attention to what I believe is a subtle relation in our farm problem between the increasing efficiency of the production of crude foodstuffs that has resulted from farm mechanization and the relatively reduced consumption of bread and meat in comparison with fruits and green vegetables that has resulted from the elimination of heavy manual labor through industrial mechanization.

However, I assume that you are less concerned with these gradual and general

changes than you are with the more immediate effects of mechanization, particularly as they affect the attitude of workers toward the introduction of improved machinery and methods. Viewing the question from this narrower angle, we have to consider the three principal charges that have been made against mechanization—first, that it tends to increase unemployment, both generally and in specific cases; second, that it leads to a nerve-wracking and health-destroying pace in production; and, third, that it is eliminating the old-time all-around skilled mechanic, and is substituting masses of workers who are skilled only in a single operation and who are mentally deadened by the monotony of their work.

With respect to general unemployment there appears to be no support, either in experience or in economic theory, for the belief that, in the long run, a mechanized industrial system will provide occupation for a smaller proportion of the available workers than a system that depends more largely on hand production. Both experience and economic theory indicate, in fact, that the tendency of mechanization is not to throw workers out of employment, but simply to shift them from the older occupations, upon which there is a relatively fixed demand for output, to newer occupations, such as the manufacture of automobiles and radio sets. There has, however, been noted by Professor Mitchell, in his recent studies of the business cycle, a tendency for fluctuations in employment to become more severe as a country advances from a purely agricultural and pastoral stage to a stage in which large portions of its population are engaged in highly organized industry and commerce. This greater sensitiveness of business to disturbances in highly organized countries has, however, no necessary or obvious relation to the mechanization of industry. It is more directly chargeable to banking and other purely commercial factors; and, as the result of a better understanding and control of these factors, particularly in the United States since the war period, we now have reason to hope that the previous tendency toward a chronic instability in business and employment has been replaced by a definite tendency toward stability. If this is the case, we are justified in assuming that, with the increasing mechanization of our activities, there will be, as time goes on, no decrease in employment, but rather a continuous shifting of workers from the older occupations to the production of the new kinds of luxury and semiluxury goods that we can use and consume as the result of receiving higher real wages and real incomes. For this

reason, I believe it may be stated as an economic truth that if we measure employment from the statistics of any group of the older established industries, and such employment fails steadily to decrease, at least relatively if not absolutely, then we have evidence not of good times but of bad times, not of economic progress but of economic backsliding. In other words, if mechanization increases the output of shoes per employe in factories making staple shoes, the result will not be to increase the output of such shoes but to decrease instead the number of shoemakers and to transfer a portion of such workers directly or indirectly to one or another of the newer luxury and semiluxury trades. The same condition holds true of our agricultural activities. The back-to-the-farm movement represents one of the greatest of economic fallacies. The producer of agricultural staples is in the same position as the producers of staple shoes and textiles, and all other commodities, including certain metals and minerals, that are subject to a relatively fixed per capita demand. Large increases in our exports of the majority of such commodities are improbable, and we must expect, therefore, that every major increase in the efficiency of production of the basic necessities of life will tend to be followed in the United States by a relative or absolute decrease in the number of workers employed in such production.

The condition just indicated is not a temporary one. The luxury trades of today will quite probably become the necessity trades of tomorrow, and even the automobile workers may have to turn in due course to the building of airplanes. While, therefore, mechanization does not cause general unemployment, it very certainly has required, and will continue to require, important redistributions of working forces. These changes involve no difficulties in the newer and more rapidly growing industries, where even the most rapid and fundamental improvements in equipment and methods still leave it necessary to make constant increases in personnel. But the condition is quite different in those older industries that are subject to a relatively fixed demand, and it may be specially serious in localities or areas where the existing industrial activities are almost wholly confined to the output of staple goods.

These special and largely localized difficulties that arise out of mechanization, in the manner just indicated, are, I believe, the source, in the United States today, of practically the only active opposition now exhibited by intelligent workers to improvements in tools and processes. Economic theories are a poor substitute for bread and butter, and I think we can all sympathize fully with the man who wants to see a practical

*"Mine operators may possibly avoid certain complications in arguments with labor organizations with which they have to deal, if they will begin each discussion with the assumption that an increasing mechanization of mining operations is inevitable, and that the only problem is to temper the effects of such changes upon the mine workers, and to establish an equitable distribution of any margin of increased earnings, above the bankruptcy line, that may result from the increased output."*

solution and not a theoretical answer to his problem, when he is deprived of employment by the introduction of labor saving devices and methods.

I shall not pretend to offer a universal remedy for this particular trouble, except to suggest that, with economic as with physical ills, an exact diagnosis and a frank recognition of the nature of a malady is often more than half the cure. However, we have, very fortunately, in the minimum labor turnover and the normal and healthful mobility of labor in the United States, a natural correction for all but the most extreme cases of this kind. If available figures may be trusted, the minimum decrease in an ordinary working force that may be expected if there are no layoffs, but simply a failure to hire new workers, ranges in the United States from 25 to 40 percent per annum. This figure may be somewhat lower in cases where the movement of workers must be from locality to locality rather than between industries in the same locality, but can hardly be less than 20 to 30 percent, even where the mobility of labor is at a minimum.

As opposed to the preceding figures, the average annual increase in the productive efficiency of industry is under rather than over 3 percent, so that, in all ordinary cases, it is possible for the transfers of labor required by mechanization to take place, without forced reductions in personnel, simply, as the result of the older industries ceasing to employ new workers. This, of course, is only a partial answer to the problem

from the standpoint of those localities or areas that are wholly dependent on the production of staple goods. In such cases, it would appear that, to avoid losses in wealth and working population, the only logical line of action is through the diversification of local output to include the production of appropriate luxury and semi-luxury goods.

With this much said with respect to unemployment, let us consider, now, the charge that mechanization leads to a health-destroying pace-making in production. Here we are on very intangible ground. I can, however, speak from close personal observation when I say that, with a perfected and smooth running organization, a high rate of production can be secured with a rhythmic effort on the part of each individual that is almost devoid of strain, and that certainly involves much less strain than a lower rate of production under an inferior organization. I know, also, that it is the object of all skilled production managers to secure and maintain this effortless smoothness of output. And finally, I have spent some time comparatively recently in watching operations in a very highly mechanized factory, where it was clear that the value of the machines and output was so great that the wages of machine attendants had become a minor item and such attendants were, therefore, employed in what seemed to be excessive numbers, merely as a safeguard against interruptions of machine operation and spoilage of materials. It is, of course, dangerous to generalize from a few specific cases as to the effects of mechanization as a whole, but there can be no doubt that as machines become more fully automatic and more costly, and as the value of the product per machine increases, mere considerations of self-interest on the part of employers will lead to a liberal provision of machine operators and attendants. The same economic restraints operate, to some degree, even in connection with those serial assembly operations that employ mechanical pacemakers, and, in any case, there seems to be no reason to believe that excessive pacemaking is, or need be, a greater evil in the highly mechanized industries than in those that are relatively unmechanized.

Now we come, finally, to the third, and perhaps the most serious, charge against mechanization, which is that it is eliminating the old time mechanic, with his all-around training, and is substituting mere machine tenders and workmen skilled in a single operation, whose intelligences are steadily being deadened by the monotony of this highly mechanized work. However, these charges appear to be made less frequently today than they were a few years ago. Our

*" \* \* \* there are three principal charges made against mechanization.*

*1st—That it tends to increase unemployment;*

*2d—That it leads to a nerve-racking and health-destroying pace in production; and*

*3d—That it is eliminating the old time all-around skilled mechanic and is substituting masses of workers who are skilled only in a single operation and who are mentally deadened by the monotony of their work."*

industrial personnel managers probably give the true explanation of this change in sentiment when they state that the problem is almost wholly one of the proper allocation of workers to the classes of employment for which they are naturally fitted, and has largely been solved by taking pains not to assign the more capable and intelligent workers to routine operations. It is not necessary to say that men and women who have the spirit of skilled craftsmen are distinctly in the minority. The majority of workers will probably continue in the future, as in the past, to look upon their work as simply a means of earning a living, and, if their pay is adequate, will be satisfied with their jobs almost in exact proportion to the extent that their work is made automatic in character. There is, in fact, as you all know, no surer way to cause trouble, in industry or elsewhere, than to try to compel a man or woman to think, who can't think, and doesn't want to think; and no one, I believe, will count it a harmful result of the increasing mechanization of industry that it is providing profitable and suitable employment on routine work for large groups of the less capable workers who otherwise might only be misfits in more skilled occupations.

This particular problem, like many others, is one of percentages and proportions. We need no scientific evidence to tell us that, in the future as in the past, the individual members of our working population will vary widely in capacity. During the recent war, the Army intelligence tests gave us approximate indications as to how the varying degrees of mental capacity were distributed. It is possible that we may see a trend in the future toward greater uniformity in intelligence, as the result of the selective restriction of immigration and, perhaps, of positive action to prevent the multiplication of the obviously unfit. But such trend will be slow at the best, and for practical purposes we may assume that individual variations in intelligence and capacity are beyond our control and that we are concerned only with increases or decreases in the average level of mental quality. If mechanized industry calls for fewer high intelligences than are normally available, then it is probably penalizing such higher intelligences in favor of the lower and is exercising an adverse influence on racial development. If, on the other hand, modern production methods and modern machine equipment are creating a demand for an increasing proportion of the higher intelligences, then they are probably exercising a favorable influence on the mental quality of our population as a whole.

No answer can be given to this question without considering the whole range of direct and indirect effects of mechani-

*"The luxury trades of today will, quite probably, become the necessity trades of tomorrow, and even the automobile workers may have to turn in due course to the building of aeroplanes."*

zation. No one will question that the successful operator of the mechanized farm of today must have a higher intelligence than the farmer of 50 years ago. No one can fail to note that the automobile and the radio set have made capable, and often expert, mechanics and electricians of a surprisingly large proportion of our population.

The preceding are important, if indirect by-products of mechanized industry. A more direct and tangible by-product is, however, the increasing demand for skilled all-around mechanics and electricians in those service stations that are required for the care and maintenance of our automobiles and radio sets, and our special household and office appliances. No manufacturer today can compete successfully in the sale of such equipment and apparatus, without giving the same attention to the establishment of service stations and service experts as to his original production.

Even if it were true that mechanized production is calling for a larger proportion of purely routine workers than did the old hand production, it is highly probable that the more skilled and versatile workers would still find full employment in these new classes of repair and maintenance work. However, there are many reasons to believe that modern production methods call directly for an increased proportion of skilled nonroutine workers. I am assured that certain new and exhaustive statistical studies, soon to be published, will show that while modern industry has less need than the old for the man who can be a blacksmith one minute and run a milling machine the next, it requires, nevertheless, in other ways an increased percentage of highly

trained workers, in the form of tool makers, machine setters and adjusters, special foremen, etc. This statistical evidence is confirmed also by my own recent personal experience, when planning the reorganization of a foreign factory. In this case it was clear that, even for the same output, the introduction of improved machinery and processes would not only utilize every skilled worker in the existing force but would require the employment of additional tool makers and other expert technicians and mechanics. Consultations with American and foreign production experts indicated, furthermore, that this had been their normal experience in reorganizing a wide variety of industrial establishments. Furthermore, a survey of the local labor market indicated that there would be much more difficulty in finding skilled employees for the skilled work than unskilled employees for the unskilled work. This latter condition, which appeared to be the result of a general movement toward the more intensive mechanization of the local industries, was perhaps the most conclusive evidence of an increase in the demand for expert mechanics.

In the United States the restrictions upon immigration have appeared for a time to reverse this trend and to put a relative premium on unskilled labor, but this tendency has, I believe, already been checked by the introduction of conveying and other machinery designed to reduce or eliminate the use of crude man power.

And now, to conclude: An increasing mechanization of our industries and our lives is inevitable. We are caught today, whether we will or not, in an economic movement that chroniclers a thousand years hence may write down as one of the great epochs in human history. This movement is not alone in machines and tools but in chemistry and physics, and in all the pure and applied sciences. It is as marked in industrial organization and management as in industrial equipment. It spreads out to affect our political forms and to change our political theories. It feeds upon itself and cumulates and gains pace as it proceeds. And it seems, in fact, to be the fulfillment of the prophecy of Henry Adams that scientific advances would hereafter speed forward with constantly increasing acceleration in the manner of a comet approaching the central sun.

On the whole, this movement has brought, and probably will continue to bring, increasing comfort to the great masses of our population. It is not true human progress. It may at times work in opposition to the refinements of living. Nevertheless it is raising higher and building more firmly each day those economic foundations upon which the ultimate structure of our progress may rest.

*"An increasing mechanization of our industries and our lives is inevitable. We are caught today, whether we will or not, in an economic movement that chroniclers a thousand years hence may write down as one of the great epochs in human history. This movement is not alone in machines and tools, but in chemistry and physics, and in all the pure and applied sciences. It is as marked in industrial organization and management as in industrial equipment. It spreads out to affect our political forms and to change our political theories. It feeds upon itself and cumulates and gains pace as it proceeds."*

# WHAT MECHANIZATION MEANS to the MINE OPERATOR\*

By J. B. PAULEY †



## MECHANIZATION A Possible Avenue To Alleviate Fundamental Difficulties In Coal Industry—Prediction As To Its Future Impossible At This Early Stage Of Development



J. B. Pauley

BY way of conclusion and summary, perhaps it may not be out of order to attempt to connect what has been said with the subject in hand. Upon an occasion of this kind, I always have the fear that my friends may say, "Yes, we heard what he said but what was it all about?" Primarily, we are searching for the many different remedies which, combined, may help to alleviate our entire situation. If a speaker or writer desires to make a complete, consummate ass of himself he has only to accept the assignment to discuss what is called the ills of the coal industry, diagnose them and recommend the remedies. A well-posted coal man, who has been forced to view the situation as it is, would hesitate to accept such a mission. Some well-meaning friend, with a partial knowledge of our situation, would take on the assignment under protest. If we would find someone who would rush into the breach with alacrity to dissect the entire subject, we would have to seek some eloquent speaker or prolific writer who knew nothing at all about it. We have seen them all perform. I should like to be placed in a class different from any of these three but do not know just what is would be. We can agree that we have just one outstanding, fundamental ailment and that is overproduction. We shall have to modify that term as it is objectionable to some of our very best thinkers who claim that overproduction is not possible. Let us then call it overproductive capacity and avoid a discussion as to the exact meaning and effect of the two terms. Beside this one great ill, there are a multitude of ailments, each one of the utmost importance, which affect us, and very vitally. These, however, are all secondary to the main issue. It is one of these that I have attempted to discuss today. Let us then, even at the expense of assuming an exaggerated attitude, attempt to trace the possibility of partially alleviating the fundamental difficulty by the application of mechanical loading. In the main, of course, its object is to keep pace with general industry, to improve methods and prac-

tices, and accordingly, to reduce the cost of production. Beyond this, however, there is a possibility that it will connect up with overproductive capacity. Assuming for the moment an agreement amongst us that mechanical loading is a substantial success under proper conditions. There are mines today operating under natural conditions which do not lend themselves to mechanical production by the present known methods and equipment. There are other mines in the hands of estimable operators which, however, are not properly financed, hence could not now enter the mechanical field. There are still other mines which have been so robbed, abused and hogged in their development that they do not belong in the economic scheme under any method of production. As a broad proposition, all these classes belong largely to the present inefficient. Should we be able to realize a considerable degree of success in the mechanization of the remaining capacity, would it

not automatically, and for the time being, eliminate the classes of mines above mentioned through the production of good, clean, fuel at a more reasonable cost and to this extent bring the natural commercial elements, supply and demand, closer together? This is simply a question for consideration. I make no predictions and recognize that even propounding the question assumes a good deal which may or may not be true. It is conceivable that this result may some time develop. Whether it is now at hand is a matter upon which, in all probability, no two men would agree.

### THE CASE for COAL

(From page 47)

the details which are to obtain. There are many of you fully able to arrange and foster the conclusion of the matter. If we do not, it is certain we shall be deemed unworthy to have so great a trust in our hands. It does not appear reasonable that the public, the industries, or the Government itself can desire that this great industry shall continue in a condition of chaos.

I believe that when proper efforts are put forth the bituminous coal industry will receive the support of all of these agencies. So let us go about it with the hope, faith, and confidence that we can discern our weaknesses, control our individualism, and employ our wisdom, skill, and fairness in a way to bring order out of chaos, and place this great industry on a plane with other industries, and give it an equal chance with them, and do it in a way that will assure the consumer a constant, ample, and well-prepared supply of coal at a reasonable price, the mine worker a wage commensurate with his labor, the owner a fair return on his investment.

For doing these things we will have the respect of the public, and of all with whom we come in business contact.

In leaving this subject with you for your consideration, I trust that you will deal with it and consider it in a spirit of optimism. The sky of the bituminous operator shows but little blue today, but with wisdom, perseverance, and the use of the great ability that exists among you, you will soon discover, I believe, that there is a silver lining to every cloud and a remedy for every ill.

\* Excerpt from paper presented to Thirty-first Annual Convention of The American Mining Congress.

† Chairman of the Board, Miami Coal Company.

# NATIONAL PROGRAM for MECHANIZATION *of* COAL MINES\*



*PROGRAM Embraces Five-Year Plan For Intensive Collection Of Data On Mechanized Coal Mining; Analysis And Publication Of These Data And Dissemination Of All Current Information On Mechanization;*

*Research Work And Compilation Of Annual Textbook*

By DR. L. E. YOUNG †

**I**N the announcement of the five-year program of the National Committee on Mechanized Mining it was pointed out that the essential features of the work would be (1) the intensive collecting of data on mechanized coal mining; (2) the analysis and publication of these data and the dissemination of all current information on mechanization; (3) the publication annually of a textbook on the subject of mechanization, to be known as the American Mining Congress Yearbook on Mechanized Mining; (4) the supervision and sponsorship of research work in the subject; and (5) the development of more complete cooperation in the solution of the economic problems in the field of mechanization.

The benefits hoped to be attained were listed as follows:

"For the public it will mean cleaner and more economical coal; for the miner, safer working conditions through better supervised, better ventilated, concentrated working places—and an opportunity to raise materially his economic status because of the numerous specialized tasks incidental to the mechanical mining of coal; for the operator it will mean more continuous and more profitable recovery of his coal; for the manufacturer of mining equipment, it offers a great opportunity to serve the industry and assist it in arriving at that efficiency and prosperity for which it is striving."

In order to carry out this program a committee, national in its scope, has been appointed. A general committee has been named with a representative for each of the following subjects: Cutting and shearing, drilling and blasting, mechanical loaders, conveyors, scrapers, transportation, ventilation, power, roof action, coal cleaning, management, safety, yearbook, and publicity; and district chairmen for each of 15 districts. These districts have been divided into 94 subdistricts, for each of which a representative has been named.

The mechanization survey, under the direction of Mr. G. B. Southward, is to be continued, and it is felt that with the cooperation of the men who have been appointed for the districts and subdistricts, as well as those who have helped

nautics, and some of the other wonders of the present age. In order to appreciate that some progress has been made in coal mining we should recall what the conditions were in coal mines when the industrial revolution began, about 150 years ago.

"The earliest miners in Scotland were serfs; the first miners in northern England were bondsmen who sold themselves by the year and were forbidden by law to leave the mine to which they were bound."

The old textbooks on coal mining showed pictures of employees, stripped to the waist, "hurrying" or dragging coal in boxes or sleds along the roadways in thin coal seams. As late as 1842 children were employed generally in parts of England, Scotland, and South Wales underground for various classes of work. An American writer, in reviewing the conditions of those days, said that "people in general deplored the horrors of mining—but the fact remained that if the golden promise of the industrial revolution was to be realized they must have coal, and what other way was there to get it? At least part of the world was living in comfort and security."

One of the first applications of steam was in the pumping of water from mines; later steam locomotives were used to haul coal in mines. The haulage and raising of coal and the ventilation as well as pumping were for many years the principal operations about coal mines which were mechanized. Steam, however, did not lend itself to underground haulage, and rope haulage was generally used until the application of compressed air and electricity became general. The use of electricity in mines covers a period of less than 50 years, and the most rapid extension of its use has been made in the last two decades. With these brief statements of fact you are all familiar.

The cutting of coal mechanically has done away largely with the arduous and hazardous labor of "digging" coal. The manual loading of coal into mine cars comprises the most widespread form of drudgery existing in industry today. It is the outstanding relic of the customs, practices, and traditions of the eighteenth century. Until recently practically all of the bituminous coal mined in the United



Dr. L. E. Young

\* Presented to the Thirty-first Annual Convention of The American Mining Congress, Washington, D. C.

† Vice President, Pittsburgh Coal Company, Pittsburgh, Pa.

States from flat beds has been shoveled by hand into mine cars. With the development of various types of loading devices, including loading machines, entry-driving machines, conveyors, scrapers, and pit-car loaders, this situation is changing rapidly. According to data at hand, the tonnage loaded by these devices, either completely mechanical or effort-saving, has been increasing about 50 percent per year. This compares very favorably with the progress in the use of coal-cutting machines during the first decade that these machines were used in the United States.

In order to determine the trend of affairs, the manufacturers of various mechanical devices were asked to furnish data as of November 1, 1928, and November 1, 1927, to show how much additional equipment was installed in the 12 months ended October 31, 1928. Most of the manufacturers responded cheerfully. There has been little opportunity to analyze the statistics that have been compiled. At best the composite figures are only an estimate, but they show the trend. Statistics on mechanical loading in bituminous coal mines in 1926, presented by F. G. Tryon and L. Mann, of the United States Bureau of Mines, were published in the Mechanization Yearbook for 1928.\* Excluding hand-loading conveyors and pit-car loaders, the tonnage loaded was 10,002,195. If to this sum is added the estimated tonnage for mine-car loaders and hand-loaded conveyors, the grand total is more than 11,000,000 tons.

No data are available for 1927, except estimates of manufacturers. Based upon data compiled by correspondence there is installed equipment, including conveyors and minecar loaders, having a capacity in eight hours of almost a quarter of a million tons, and a probable daily output of 175,000 tons. Assuming 200 working days a year, there is probably installed and operating as of November 1, 1928, mechanical loading equipment capable of producing at the rate of 35,000,000 tons per year. These figures indicate the tonnage that can be loaded mechanically in 1929 if the industry averages 200 working days.

As previously stated, these estimates have been introduced solely in order to indicate the trend. It is worthy of note that the new wage agreements in certain districts have for the first time designated rates to be paid for the operation of these new mechanical devices, and have also provided for the negotiation of local agreements that will make it possible for new devices to be used when either they do not have possibilities for general application or when the conditions of the general wage agreement can not be ap-

plied to some particular mine under existing competitive circumstances.

The opposition to mechanization coming from certain quarters appears ill-advised and is not supported by any constructive suggestions as to alternatives that would provide any remedy or relief in the reorganization of the coal industry. As stated previously, the loading of coal by hand is the last of the great tasks that are real drudgery. In the great evolution of industrial society following the so-called "industrial revolution," we have lagged somewhat in coal mining. We believe we are entering a period of reorganization in the coal industry, and the American Mining Congress, in announcing its five-year program on mechanization, has taken a step that indicates not only a willingness to continue a work begun in a commendable fashion but a determination to carry on a constructive program to a successful conclusion.

As we review great epochs in history, beginning with the civilizations of the Egyptians and of the Babylonians, we find that for at least 4,000 years practically every great contribution in the form of structures, highways, art, literature, etc., came about because of conquest, slavery, and subjugation of peoples. Leisure and prosperity of one class always meant the slavery and degradation not only relatively but generally absolutely of the remainder of society. The building of the pyramids was possible only on account of the manual labor of slaves; the construction of the great temples and of the Roman highways and aqueducts was the result of slave labor; the feudal system, with its attendant subjugation of labor likewise made possible many beautiful buildings in Europe. Prior to this industrial age the poet sang and the artists and others made their contributions to civilization because leisure was made possible by the cheap labor of slaves and peasants. The hours of labor were long and the standards of living for this labor were low—unbelievably low as compared with those of today.

With the development of the factory system late in the eighteenth century many evils came, but these were abolished largely with the application of power-driven machinery.

Today the great contributions to culture and civilization are cumulatively improving the conditions of the worker, raising all the standards of living, and freeing people from the severe labor which characterized the life of the workers prior to the advent of steam. The ploughing of fields, the harvesting of grain, the digging of ditches, the tamping of railroad ties, the drilling by the construction gang, the stoking of locomotive boilers as well as those of ships and power plants, the cutting of stone, the

bearing of burdens, the washing of clothes, the sweeping of floors and streets, the sewing of fabrics—all these and many others are being done mechanically, and the worker who has been freed from such tiring labor has generally found a more pleasant and more remunerative task to perform.

Moreover, the use of machinery has made it possible to produce the same goods or the same result at a lower cost, and thereby made it possible for more people to purchase these goods or services. Standards of living have been improved and, in spite of hardships that may occasionally develop for a brief time following the introduction of new machines and new methods, the readjustments that have resulted have always brought about general improvements. H. W. Cope, of the Westinghouse Company, has pointed out the fact that Americans generally hope and expect to get the best of everything—"automobiles, silk stockings, radio, modern houses; all are kindred phenomena"—and these have been made possible by the introduction of machinery.

In a report on American conditions entitled "The Secret of High Wages," two British investigators said:

"The term 'labor-saving devices' is a particularly unhappy one which has been widely misunderstood in Great Britain. Labor-saving machinery has come to be regarded as a device for doing away with labor—meaning men. It should rather be thought of as time-and-trouble-saving machinery. It is machinery for helping the working man to increase his output and his earnings and, therefore, under proper management, to raise his standards of living.

"It is accepted in America that the higher the wages labor is able to earn, the better it is for the community as a whole, since it enables the working man to raise his standard of living. With higher wages he can afford to obtain some of the comforts of life and these stimulate his desire for more comforts and even luxuries. The logical outcome of this state of things is that he is incited to greater effort in his productive capacity."

In the transportation of goods from Tientsin, China, to the desert of Gobi, coolies carry all the merchandise, working for only a few cents a day. In contrast with this, here in the United States vast amounts of capital have been invested in roadbed, track, locomotives, and cars. Trains operated by crews of well-paid trainmen provide transportation at about 1 percent of the cost of such service in China. The cheapest labor in the world may prove to be the least economical. It has been stated that the average output of a workman—that is, his own physical effort—is at the rate of one-tenth of a horsepower throughout the day. It has been estimated that "the total developed horsepower in the United States is sufficient to give every man,

\* Yearbook on Coal Mine Mechanization, 1928 (Southward.) Published by The American Mining Congress.

woman, and child service equivalent to that rendered by 150 slaves, and the power houses of this country are doing more work than could be accomplished by all the able-bodied men in the world working from sunrise to dark." Obviously, in the United States it is no longer economical to use manual labor when power can be applied through machines.

In 1925 there was published an outstanding volume, entitled "The Miners' Fight for American Standards." The author, Mr. John L. Lewis, president of the United Mine Workers of America, reviewed the recommendations of the United States Coal Commission as to mechanization, and said:

"The miners face the future of mine mechanization in the same spirit of willingness to cooperate in the introduction of loading machinery and every other mechanical aid that has characterized their past policy.

"The economic history of the United States in the last half century is replete with instances in which great inventions have been resisted by reactionary management or suppressed by short-sighted finance, unwilling to scrap obsolete equipment. The policy of the United Mine Workers will undoubtedly bring about the utmost employment of machinery of which coal mining is physically capable. Fair wages and American standards of living are inextricably bound up with the progressive substitution of mechanical for human power. It is no accident that fair wages and machinery will walk hand in hand. All will agree that fair wages are only possible because of the increased productivity per worker, secured largely by advanced methods and means of production. It is equally true that such wage rates are the principal incentive for the invention and installation of new devices."

With this assurance of moral support and of cooperation, the American Mining Congress program for the elimination of drudgery and the improvement of standards of living in the coal industry will undoubtedly go forward with increased vigor.

The national committee is to be the sponsor for investigations and research work and to be the clearing house for data accumulated from private sources. It is hardly necessary before a group of this character to urge the importance of research work. A large part of the progress made in American industry is the direct result of investigations in pure science. Recently an address was made before the Royal Society of Scientific and Industrial Research, at Stockholm, in which it was pointed out how opinion has changed regarding the commercial returns from research. "Investment bankers are becoming more and more particular about guarantees for future dividends, and the company looking for loans finds it easier to negotiate them if the research department looms large in the picture of its assets." The whole of the modern electrical industry, in which

6,000,000 people are employed in the United States alone, really owes its existence to research work in electro-magnetic induction.

The iron and steel industry has made tremendous strides in the last decade in the use of fuel and in the application of electric power. Locomotive engineering, combustion engineering, and power-plant engineering have followed scientific investigation, industrial research, and studies in the engineering economics with real cooperation in the exchange of ideas and in the development of standards in design and practice. These records of achievement challenge the coal-mining industry to corresponding advances. Among the hopeful indications of a new era are the records of progress in mechanical loading in Indiana, Illinois, Wyoming, and Montana and the realization that the leaders in these states have set themselves grimly but hopefully, with united front, to carry on the work in which they have made such commendable progress in the last two years.

Sufficient progress has been made with various types of mechanical devices to warrant the statement that the manufacturers are ready and eager to cooperate in the Mining Congress program. For one set of conditions a certain type of equipment finds ready sale today, but with changing market, labor, and other conditions, improved equipment will be required. The highest type of commercial research and cooperation is essential.

In a recent paper by Mr. George J. Anderson, president of the Consolidation Coal Company, he advised "closer cooperation" and a "new attitude of mind." He added that for a "new attitude of mind, all a normal man (in the coal business) should need is a few frank hours with himself." Undoubtedly the men who have decided to mechanize have had a "few frank hours" with themselves and have this "new attitude of mind."

A splendid spirit of cooperation has made possible the field work of Mr. Southward, the mechanization engineer. With continued support, your committee looks forward with hope for a virile and constructive program during the next five years.

#### COAL'S RELATION || and who do in to GOVERNMENT || England and other

(From page 45) countries which do not have the benefit of these laws, dominate, control and eventually destroy many industries.

President Coolidge, in his message to Congress Tuesday, said:

"Agriculture has lagged behind industry in achieving that unity of effort which modern economic life demands. The cooperative movement, which is gradually building the needed organization, is in harmony with public interest and, therefore, merits public encouragement."

This same statement should apply with equal force to coal. We can bring about this closer cooperation in our industry by taking greater interest in our associations, local, state and national, which, of course, includes the American Mining Congress. Furthermore, there is reason to believe that the attitude of the Federal Government is favorable to the forward-looking, cooperative programs of the trade association movement. There is excellent ground for this belief, in which connection I might mention recent visits which a committee of the National Coal Association had with Colonel Donovan, Assistant to the Attorney General, and Chairman Myers, of the Federal Trade Commission. Numerous problems of the bituminous industry were discussed with these government officials, who evinced a broad understanding and displayed a sympathetic attitude. From the incoming administration increasing support of policies mutually helpful to the public and the industry may confidently be anticipated. Encouragement of this cooperation of which I speak by the Federal authorities will surely be a helpful factor and real cooperation will bring us in closer touch with our neighbors and enable us to better understand our problems. Such contact and cooperation will result in consolidations, mergers or joint selling companies as will then best serve the conditions in each district.

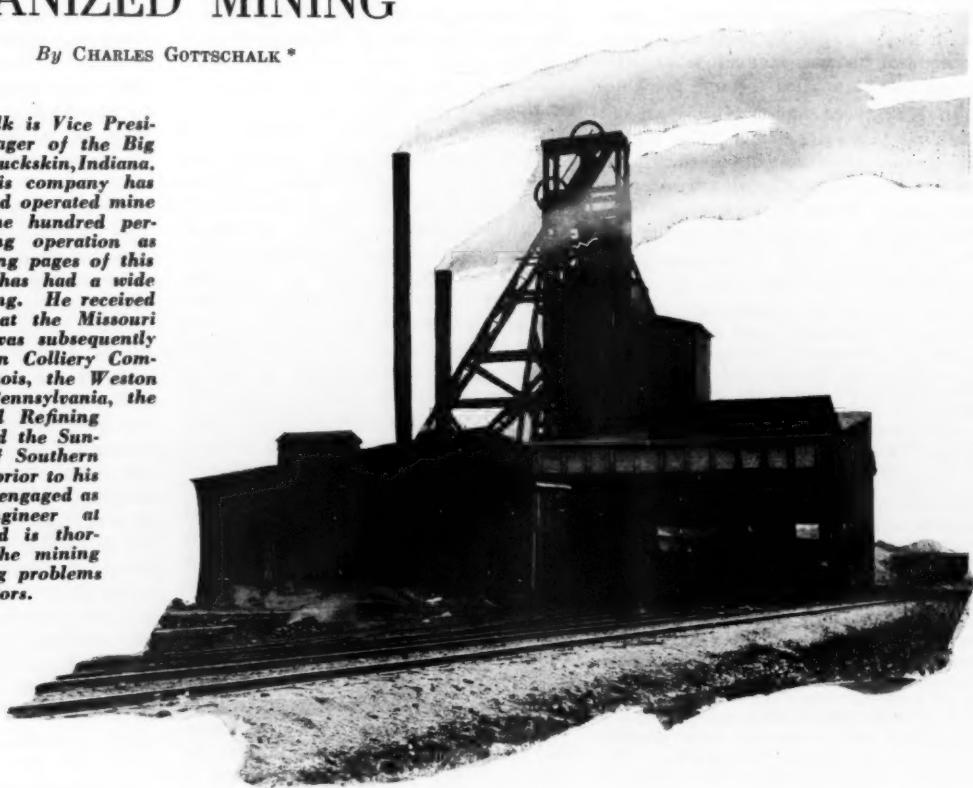
#### FUMES PRODUCED IN BLASTING

Dynamite used in underground blasting must produce the least possible amount of poisonous fumes in order that the hazard of asphyxiating workers at the face may be reduced to a minimum. In an investigation being conducted by the Pittsburgh Experiment Station of the United States Bureau of Mines, in cooperation with the Hercules Powder Company, experimental blasting tests are being made with a series of specially prepared dynamites of varying chemical composition in order to determine the mixture that produces the least possible fumes. A blast is fired in a tunnel which is bratticed off so that the gases from the detonating explosive are confined in a relatively small volume. Samples of the atmosphere in the tunnel after the blast are taken for analysis by men wearing breathing apparatus. The toxic gases produced by dynamites are found to be mainly carbon monoxide and oxides of nitrogen. The amount of these gases produced depends upon the composition of the explosive and the method of loading, factors which are being investigated by the Bureau of Mines. Modern gelatin dynamites produce relatively small quantities of fumes.

# An ANALYSIS of the POSSIBILITIES of MECHANIZED MINING

By CHARLES GOTTSCHALK \*

**Mr. Charles Gottschalk is Vice President and General Manager of the Big Vein Coal Company at Buckskin, Indiana. Under his direction this company has rehabilitated an old hand operated mine and has installed a one hundred percent mechanical loading operation as described in the following pages of this issue. Mr. Gottschalk has had a wide experience in coal mining. He received his technical training at the Missouri School of Mines and was subsequently employed by the Union Colliery Company of Southern Illinois, the Weston Dodson Company of Pennsylvania, the American Smelting and Refining Company in Mexico and the Sunlight Coal Company of Southern Indiana. Immediately prior to his present position he was engaged as consulting mining engineer at Evansville, Indiana, and is thoroughly familiar with the mining conditions and operating problems in that field.—The Editors.**



THE men interested in the Big Vein Coal Company believed in mechanical coal loading before mechanical loaders had arrived.

With the appearance of the first machine which seemed to embody design and constructive features to justify the experiment, these men readily made the necessary investment in equipment.

Today the results as interpreted by this organization, after a year and half of operation, are as follows:

Mechanization is no



Charles Gottschalk

longer some fanciful man's hobby, but a necessary procedure for all coal companies which expect to meet present day competition.

That it is not lower wages which will help the coal fields which have been losing ground, but a larger production per employe through further perfection of all classes of mining machinery which contribute toward production.

No doubt new practices and improved planning of mines will develop rapidly, but even continuing with the present systems, mechanized mining offers much opportunity for improvement and further economies.

In a majority of mines employing mechanical loaders the same mining machines, electric drills, locomotives, etc., are in use that were designed to meet the requirements of hand loading. As a result, the loading machine is probably nowhere being utilized to its fullest possibilities.

At hand-loading mines an average output per employe of 5 tons is not unusual. At mines using mechanical loaders the output per employe has been doubled. In

modern strip mines, whose number is increasing, it is not uncommon to find a production ranging from 15 to 20 tons per employe.

Imagine, if you can, a scale of wages so low in hand-loading mines as to permit them to compete with a mine getting 20 tons per employe by use of modern machinery.

On the other hand, it does not take more than an elementary analysis of present-day mechanized mining practices to find room for improvements which when made will narrow to a very small margin the advantages of large production per employe now seemingly enjoyed only by strip mines.

The mechanized mine is not looking for the employe with a "strong back and a weak head." Brains, loyalty, and those other attributes are required, which when possessed by an individual cause industries to bid for his services.

Thus we see in further mechanization not only cheaper fuel for the consumer but a higher level of wages for the employe, and a profit for the mine owner.

\* Vice President and General Manager, Big Vein Coal Company.

# MECHANIZATION REPORT

## *on the*

### BIG VEIN COAL COMPANY

By G. B. SOUTHWARD

THE mine of the Big Vein Coal Company at Buckskin, Ind., is worked entirely with mechanical loaders. This operation is a very convincing illustration of the economies over hand mining which mechanical loading has been able to effect in this field and the evidence of these economies lies in the fact that the mechanical loaders are being successfully operated in a mine which had at one time been worked with hand loading but had been closed down and abandoned as unprofitable.

The property is located in Gibson County in southern Indiana, about 20 miles north of Evansville on the C. C. C. and St. L. Railroad. The coal is about 200 ft. under the surface and is known as the No. 5 Vein. The seam varies from 6 to 8 ft. in thickness of fairly hard structure coal with no regular partings and with rather favorable mining conditions. The roof usually stands well although occasional bad top areas are encountered. The seam lies fairly level but local rolls are encountered over short distances. Open lights are used and the entries are rock dusted.

The mine is a shaft operation which was opened some years ago and was worked with hand. During the first three months of the year 1924, the work had become very irregular and after March no coal was mined. The pumping and ventilation were continued, however, until June, 1924, when the property was closed down and the mine abandoned. This operation had used no machines underground. All mining was by pick work and the haulage was with mule and driver using single teams for gathering and spike teams for the main mine haulage. The track was of light steel on 36-in. gauge and the mine cars were about 1½-ton capacity. The tipple had no coal preparation equipment except gravity screens.

#### REORGANIZATION AND REHABILITATION

After the shutdown, the mine and the

#### Report No. 91

THIS description of the mechanized mining operation at the Big Vein Coal Company is the first of a new series of mechanization reports which are to be continued during the coming year.

This company has demonstrated how mechanization can be applied to change an unprofitable hand operation into an efficient and economical producing mine and the report has attempted to show how this change has been made and what it has involved in the way of remodeling the plant and equipment, in the installation of new machinery, in the modification of the mining system and the different classifications of the labor used.

In addition to reports comparing hand and mechanized mining similar to the one here submitted our subsequent series will also describe the advancement and development of mining practices which have been made during the last year in mines covered by our previous mechanization reports.

surface plant lay idle for about two years. In the early part of 1926 the property was acquired by the present owners with Mr. Charles Gottschalk as vice president in charge of operations. The new management under Mr. Gottschalk's direction planned to eliminate hand loading and to mechanize the operation completely, using mechanical loaders, cutting machines and electric haulage.

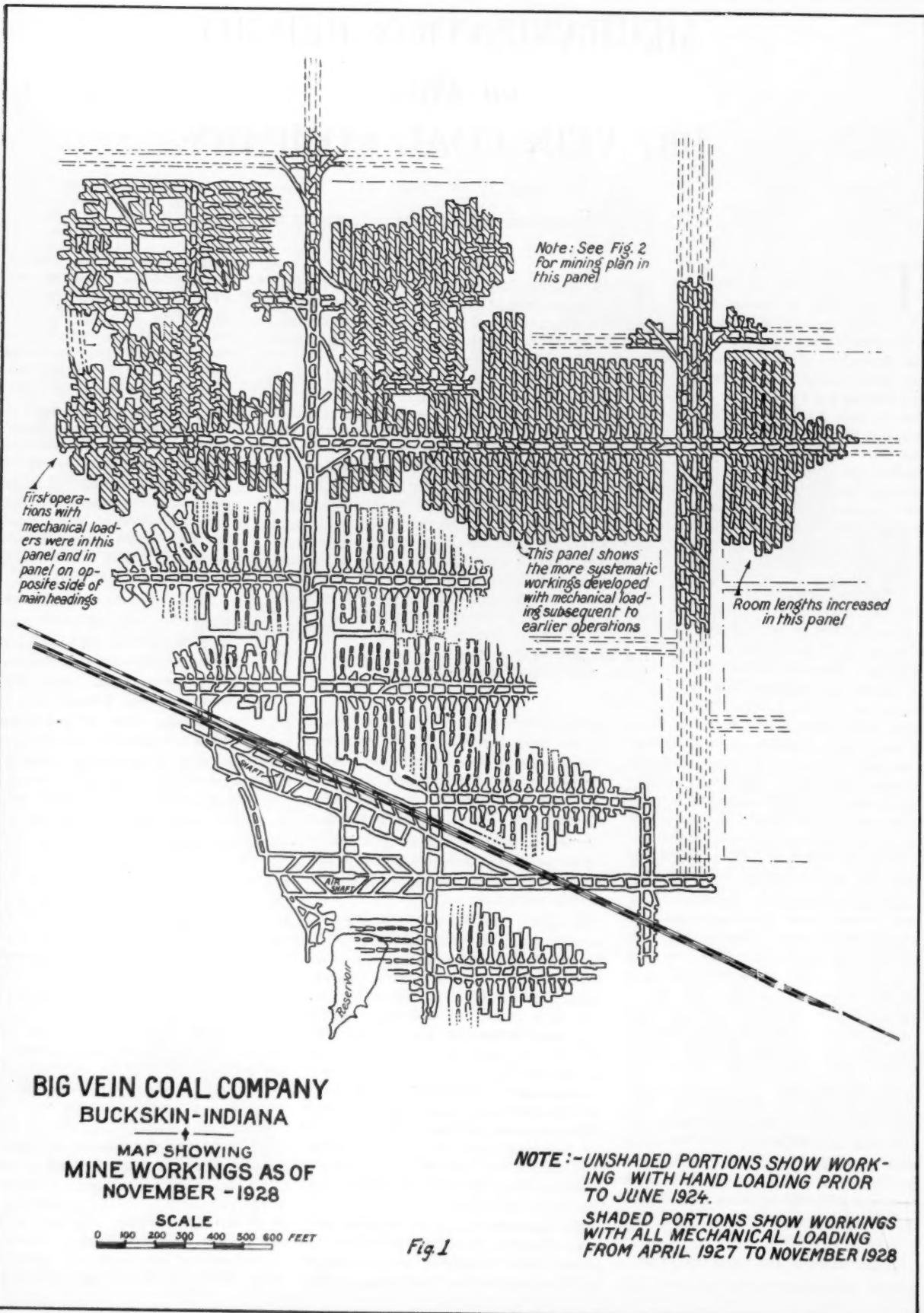
In June, 1926, work was started on rehabilitating the surface plant, remodeling the tipple and pumping the mine workings. In December, 1926, underground remodeling was begun; the entries were cleaned up and where necessary were retimbered, the old track was torn out and relaid with new steel. Trolley wire, feeder lines and mine telephones were installed; mechanical loaders, electric locomotives, cutting machines and mine cars were purchased and delivered. All this work required several months time and the first coal mining by the new company was started with mechanical loaders in April, 1927.

The tipple is a wooden structure and was originally equipped with gravity screens only. There were no preparation facilities and the coal was picked on the

railroad cars. This structure was remodeled and shaking screens were installed to prepare three sizes of coal with picking tables and loading booms for the lump and egg. There is also a "mixing conveyor" for combining the picked lump and egg with the slack so as to furnish prepared run-of-mine. As the coal seam does not contain an excessive amount of impurities, no mechanical refuse disposal is necessary; the pickings are conveyed into a small bin and hauled from there by horse and wagon to a dumping ground in the near vicinity.

The hoist shaft and cages were originally built for small mine cars of 1½ tons capacity. The plans for the mechanized operation contemplated using Sanford-Day drop bottom cars of 3½ tons capacity. Cars of this larger size could not be handled on the old cages and in order to eliminate the construction work necessary to enlarge the shaft a single skip hoist was installed. This is an automatic dumping type as designed and furnished by Allen and Garcia. With this arrangement, the shaft has two hoisting compartments—one for the skip and one for the man and supply cage as shown in Figure 4. This installation necessitated sinking the shaft below its original level so as to provide space for dumping the mine cars into the skip but did not require any widening or other enlargement of the shaft proper. The skip has a capacity of one mine car and this installation has proved satisfactory and adequate for the daily tonnage so far produced and will handle an increase over the present output.

When the mine was reopened, a part of the workings were flooded but since the mining with mechanical loading was to be concentrated in a small territory, it was not necessary to pump and clean up all of the old entries. The new haulage system was installed for electric locomotives and this meant that the haulways which were to be used had to be



completely rebuilt. Where possible the ribs were slabbed so that the new track could be laid to a much better alignment than was had in the old workings and in some places new grades were made through local rolls. The old rail was torn up and relaid with 40-lb. steel and the track gauge was changed from 36 to 42 in. All frogs and switches were of the manufactured type furnished by the Central Frog and Switch Company.

#### MECHANICAL LOADING

In April, 1927, the first loading machine was put in operation. The mining plan used at that time was a continuation of the room and pillar method previously used in the hand loading but before much tonnage could be mined it was necessary to develop working territory for the machines. As the development was extended, additional machines were added and by August, 1927, six mechanical loaders were in operation and produced approximately 17,000 tons during that month. The loaders are all the Joy type 5 BU, and at the present time four of these are working entries and rooms in advancing panels and two are on entry development only.

The map in Figure 1 shows the territory mined by the machines since their installation. During the year and a half that mechanized loading has operated on this property the mining system has passed through several modifications from the room and pillar method first employed. This evolution can be seen on the map in Figure 1. The method which has recently been designed is now being started in one panel as indicated on this map and the details of this plan



New and old mine cars.



Picking tables and tipple crew.

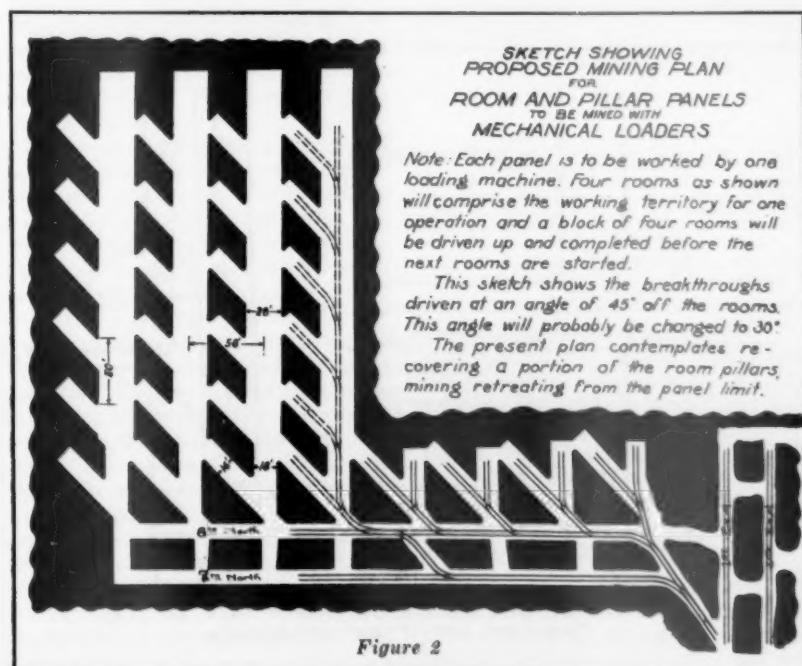


Figure 2

#### SKETCH SHOWING PROPOSED MINING PLAN FOR ROOM AND PILLAR PANELS TO BE MINED WITH MECHANICAL LOADERS

Note: Each panel is to be worked by one loading machine. Four rooms as shown will comprise the working territory for one operation and a block of four rooms will be driven up and completed before the next rooms are started.

This sketch shows the breakthroughs driven at an angle of 45° off the rooms. This angle will probably be changed to 30°.

The present plan contemplates recovering a portion of the room pillars, mining retreating from the panel limit.

are shown in Figure 2. This method does not involve any fundamental change from the room and pillar method used in this field but it does provide systematic concentration of working places well suited to the requirements of mechanical loading. No pillars have as yet been recovered with the machines but experiments along this line will be tried under the proposed new plan.

Each loading operation is organized as a complete and separate unit with all the work from the face to the main line haulage included as parts of the unit. The regular equipment for one operation consists of one Joy 5-BU loading machine, one Goodman electric cutting machine, one Dooley electric hand drill and one Goodman trolley and cable gathering locomotive. All work is done on a single shift of eight hours except when an occasional delay in any one of the regular operations necessitates extra or overtime work. Each unit has a sufficient number of working places under development so that all the mining operations may be performed simultane-



Loading machine and crew



Room face shot down.

ously and continuously during the shift without interfering with each other.

A regular crew for one unit operation consists of eight men. Two men operate the mechanical loader and two men on the gathering locomotive serve the machine—placing the cars one at the time. Two men operate the cutting machine and two men with an electric drill do the drilling and blasting. All coal is shot with "Big Red" permissible explosives made by the Equitable Powder Manufacturing Co.

As shown in the schedule in Table 2 there are 30 men employed underground for main haulage and other work not directly connected with the loading. One main line locomotive delivers the cars from the six loading machines to a side-track at the shaft bottom and a shifting locomotive hauls the trips through the dump. One man controls the dumping and signals for the hoist. A night locomotive crew of two men delivers supplies for the following day's use. In addition to the track men, timbermen and others usually required for general inside work

there are four electricians and mechanics employed for machine maintenance and repairs.

There is not a great amount of underground machinery or equipment outside of that used directly in connection with the loading operations. A small triplex Gould pump handles sump water from the shaft and two Weinman 60-gallon centrifugal pumps handle the water from the mine workings through bore holes to the surface. A system of underground telephones connect the mine workings to the office. Near the shaft bottom where the trip dispatcher is stationed, there is a phone connection directly to the office and the dispatcher by a bell signal calls directly to the mine station where communication is wanted. As the dispatcher has a direct connection with each mine telephone station, this eliminates the need of code signal rings.

On the surface the fan is a Jeffrey multiblade type, electric driven, with a 25-h. p. motor, rated at 60,000 cubic feet of air per minute. The power is purchased at 2,300 volts A. C. and is converted to 250 volts D. C. through 150 k. w. Ridgeway and a 200 k. w. Westinghouse motor generator set operating in parallel. A Sullivan bit sharpener prepares the bits for the cutting machines and a sand dryer supplies sand for the locomotives which is delivered through a borehole from the dryer house to a hopper underground.

#### COMPARISONS OF HAND AND MECHANIZED MINING

The extent of the workings with hand mining and area which had been mined at the time the hand operation was discontinued is shown on the map in Figure 1. Complete information as to the exact

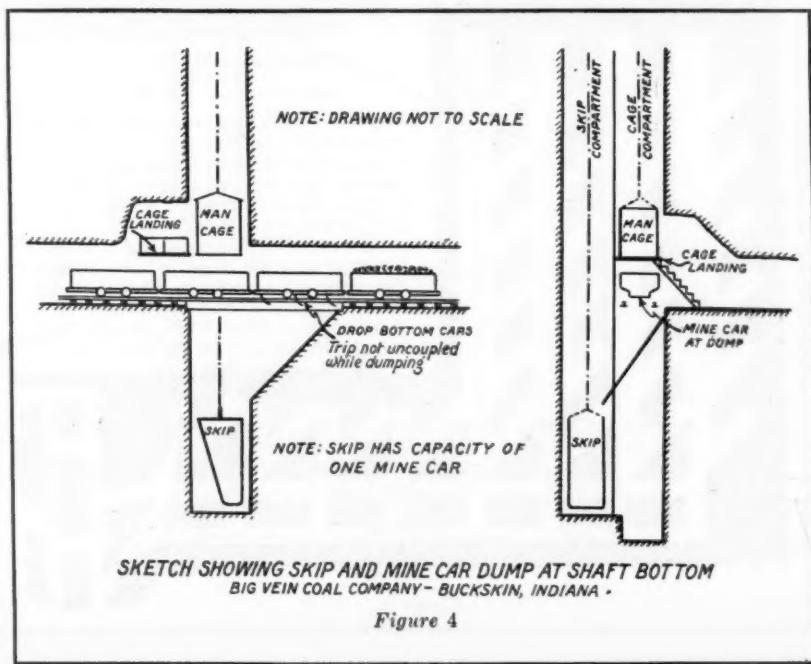


Figure 4

TABLE I  
Monthly Tonnages With Hand and Mechanized  
Mining

Tonnage Produced by Hand Mining During Jan-  
uary, February and March, 1924

	Tons Mined	Days Worked
January	11,470	18
February	8,546	13
March	7,987	12
Total	28,003	43

Average—651 tons per day.

Note: (No tonnage mined during April, May and June—pumping and ventilation only.)

Record of One Year's Operation With Mechanical  
Loaders—Tonnage Produced

	Tons Mined	Days Worked
1927—		
April	3,851	..
May	5,608	..
June	11,391	..
July	13,813	..
August	16,937	..
September	14,653	..
October	9,990	14
November	16,098	18
December	21,052	25
1928—		
January	17,981	20 $\frac{1}{2}$
February	17,998	18
March	21,483	19 $\frac{1}{2}$

Total tons mined during first  
year of operation..... 170,800

Average—1,100 tons per day during March, 1928.

Summary of Year's Operation with Mechanical  
Loading

249 Days—Hoisted.	
52 Days Idle—Sundays.	
11 Holidays.	
33 Days account no market.	
7 Days tipple construction.	
2 Days breakdown.	
8 Days pending wage agreement.	
4 Days other causes.	

366 Days—Total.  
Excluding Sundays and holidays this mine operated  
approximately 80 percent of full working  
time.

number of working places which were under development at the time of the shut-down is not available but the records of the company show that 85 miners were employed. The map indicates as well as could be determined that there were at least 86 live working places under development in the hand operation—70 rooms and 16 entries. The tonnage produced from these places during the last three months that the mine operated is given in Table 1. This averaged about 650 tons per day.

The tonnage produced with mechanical loading during the first year of operation—from April, 1927, to April, 1928—is also given in Table 1. During the first several months of that year the mine was going through a development period but by October, 1927, an average daily production of 710 tons was being mined. During the subsequent six months, the daily output was continually increased and after one year's operation—during the month of March, 1928—an average production of 1,100 tons per day was mined. This tonnage has been maintained in recent months and now that less development is required an average production of 1,200 tons per day is anticipated for the coming year. This will be loaded with six machine operations—five on day shifts in room and pillar panels, and one on night shift for main entry driving.

TABLE II  
MEN EMPLOYED FOR HAND AND MECHANIZED MINING

To Produce 1,100 Tons Per Day With Mechanized  
Mining

Supervision:
1 Superintendent.
1 Assistant Superintendent.
1 Chief Electrician.
3 Section Bosses.
1 Night Boss.
1 Fire Boss.

8 Total Supervision.

Cutting—Loading, Gathering:
12 Loading Machine Operators.
14 Cutting Machine Operators.
14 Drillers.
12 Gathering Motormen and Tripiders.
52 Loading Machine Crews.

Main Haulage and General Underground:

2 Main Line Motormen and Tripiders.
1 Bottom Locomotive Motorman.
2 For delivery of supplies.
5 Trackmen.
2 Timbersmen.
1 Bratticeman.
3 Trappers.
1 Pumper.
1 Cager.
8 Miscellaneous inside labor.
4 Electrical and Mechanical Repairmen.

30 Total General Underground.

Surface Employees:

2 Blacksmiths.
2 Hoist Engineers—day and night.
1 Fireman.
9 Slate Pickers.
3 Car Trimmers and Doppers.
2 Teamsters—slate and refuse.

19 Total Surface.

Summary:

Supervision.....	8
Machine Loading—Gathering.....	52
General Underground.....	30
Surface.....	19

Total Men Employed..... 109

To Produce 650 Tons Per Day With Hand  
Mining

Supervision:
--------------

1 Foreman.

1 Assistant Foreman.

1 Outside Foreman.

3 Total Supervision.

Mining—Loading, Gathering:

8 Pick Miners.
1 Shot Firer.
8 Gathering Drivers.

94 Total Loading and Gathering.

Main Haulage and General Underground:

5 Spike Team Drivers.
2 Trackmen.
1 Bratticeman.
1 Trapper.
2 Pumpers.
2 Cagers.
3 Miscellaneous inside labor.

16 Total General Underground.

Surface Employees:

1 Blacksmith.
1 Hoist Engineer.
2 Firemen—day and night.
6 Tipplemen—trimmers, pickers, etc.
1 Weigh Boss.
1 Stable Man.

12 Total Surface.

Summary:

Supervision.....	3
Mining—Gathering.....	94
General Underground.....	16
Surface.....	12

Total Men Employed..... 125

TABLE III  
COMPARISON OF AVERAGE NUMBER OF ALL MEN EMPLOYED—SURFACE AND  
UNDERGROUND

Mechanical Loading				
Ton per Shift—1,100				
Men				
Employed	per Man	Employed	per Man	
Supervision.....	8	137	3	217
Cutting—Loading.....	40	28	86	7 $\frac{1}{2}$
Gathering.....	12	91	8	81
Main Haulage.....	3	367	5	130
Mechanical Repairs.....	4	275	..	..
Track and General Underground.....	23	48	11	59
Tipple.....	14	80	7	93
Hoisting and General Surface.....	5	220	5	130
	109		125	
				5.2

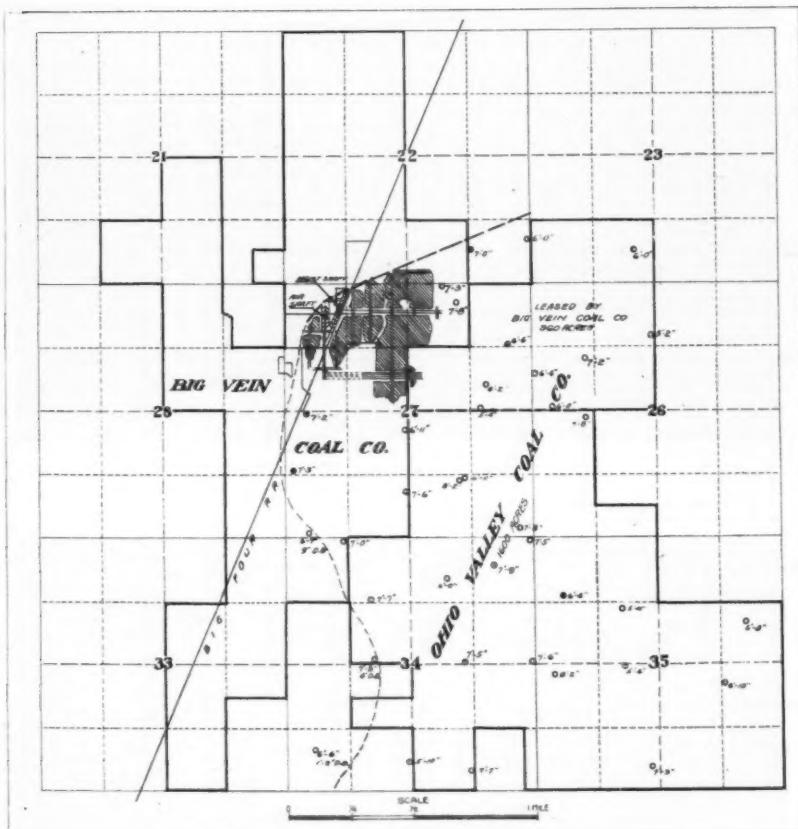
In submitting the above figures two factors must be called to attention. The first is that the hand operated mine is not a typical example of modern hand loading, as there were no cutting machines or mechanical haulage used. The second factor is that the number of men shown for producing the daily tonnage were as given on the payroll and while the figures represent the regular crews employed they do not take absences or overtime into account. It is very probable, however, that a comparison made from the daily time sheets would very closely approximate the figures in the above table.

The map in Figure 1 shows that 20 entries and 40 rooms are now under development for the present daily output with mechanical loading. Comparing the tonnages produced and the working places required for both systems of mining indicates that with mechanized loading the mining area is concentrated or reduced to approximately one-third of the working places required for the same production with hand loading.

Table 2 gives the number of men employed in the hand and mechanized operations. The hand mining records show that 125 men were employed inside and

out for an average production of 650 tons per day. In the mechanization operation a total of 109 employees inside and out produced an average tonnage of 1,100 tons per day. These figures indicate that with hand mining an average of 5.2 tons were mined for each man employed and with mechanized loading this daily average was increased to about 10 tons per man.

In Table 3 the comparison of the labor is carried further by showing how the total number of men are divided among the various mining operations. These figures indicate that mechanized mining



*Figure 3. Map showing property lines and drill records*

requires greater supervision, more men for tipple work and more general underground labor than is used in hand work but in all the other operations mechanized mining has resulted in a greater production from the labor employed.

When the mine was re-opened in 1927, the men who had formerly worked here in 1924, were given the first consideration for employment. This meant that men entirely untrained for machinery were expected to operate an all mechanical mine and the problem of forming a working organization was made more difficult by the fact that the management was new and had no previous knowledge of the individual abilities of the men.

During the development period when most of the work consisted of cleaning entries and various items of construction the management tentatively selected for machine operators those men who appeared to be best qualified for this class of work. As each machine was installed the crew was trained for its operation and an educational campaign was carried on by the management among all its employees to convince them of the practicability and advantages of mechanized mining. The success which attended the instruction and educational efforts made by the management is shown by the fact that about 90 percent of the old employees

are now at work in the new operation. This record speaks particularly well for the cooperative spirit which was created in this organization and which has resulted in developing a successful mechanized mine operated by men who had no previous training or experience with modern mechanical methods.

The operating record given in Table 1 shows that this mine worked at 80 percent full time during its first fiscal year from April, 1927, to April, 1928. This record is a very convincing indication of the ability of a mechanized mine to meet present market requirements and is further emphasized by the report that several hand mining operations in this vicinity whose combined capacity would be approximately 5,000 tons per day have closed down within the last six months because of their inability to compete in the present market.

The map in Figure 3 shows that the original holdings of the first company included a tract of 1,400 acres but the new company has acquired additional adjoining tracts so that their total holdings now include a boundary of approximately 3,000 acres. This map also shows the prospect drill records which indicate the thickness of the seam. The consolidation of these properties by the Big Vein Coal Company evidences the sincerity of their

belief that mechanized mining can and will continue to be practicable and economical for this field.

## VALUE OF ANALYSES OF DELIVERED COAL

Coal analyses help to describe the character of coal as it lies in the ground or as it may be delivered to the user, points out the Bureau of Mines. There is a distinct difference between "mine samples" and "delivered samples." Analyses of mine samples of coal are plentiful, but available analyses of delivered coal are relatively few. Mine samples are collected according to a standard method. The sampler cuts a channel 2 by 6 in. or 3 by 4 in. from roof to floor in the face of the bed and excludes from the sample any partings more than three-eighths inch thick and any lenses or concretions of sulphur or other impurities more than 2 in. in maximum diameter and one-half inch thick.

Analyses of mine samples form a permanent or scientific record of the coal bed at the point sampled; they are important in determining the character of the coal in any given mine or district. When the samples are taken in a standardized manner, these analyses are valuable to the operator. When compared with analyses of delivered coal they show him whether or not his mine is being efficiently worked or whether the coal is being properly prepared—which involves the question of whether he has suitable mechanical appliances for separating the impurities.

In the purchase of coal, mine samples may serve as a reliable guide to the experienced purchaser who has knowledge of the impurities in the bed and the degree to which these are eliminated in mining and preparing the coal.

In sampling delivered coal the Bureau of Mines follows a definite procedure. A sample of not less than 1,000 pounds is systematically collected by taking equal increments at regular intervals throughout the delivery while coal is being loaded or unloaded and by crushing, mixing and reducing this sample by successive stages to laboratory size.

Delivered coal from any given mine may differ from day to day through variations in mining or preparing the coal. Hence, a record of analyses of delivered coal for any one time should not be considered as a permanent record, for the output may be greatly improved by new methods of mining and preparation or, on the other hand, the output may deteriorate through carelessness in mining or preparation. These records of delivered coal indicate more nearly what the consumer is likely to receive, but the amount of coal represented and the number of analyses made must be carefully considered.

## PRACTICAL OPERATING MEN'S DEPARTMENT



### COAL

NEWELL G. ALFORD  
*Editor*



*Practical Operating Problems  
of the Coal Mining Industry*

## APPLICATION of ELECTRICAL EQUIPMENT to MINE HOISTS

By J. E. BORLAND \*

*Procedure Of Determining  
Proper Ratings And Type Of  
Electrical Equipment For A  
Given Service, Discussed—Typical  
Installations As Guide  
To Solving Problems  
Given*

In recent years numerous articles have been published on the general subject of electric hoisting, for the most part, describing the various forms of equipment used or analyzing different systems of operation, but there has been little information concerning the procedure of determining the proper ratings and type of electrical equipment for a given service. It is believed, therefore, that a discussion of this subject will be of interest and value to mine operators and engineers who are concerned at times with hoisting problems.

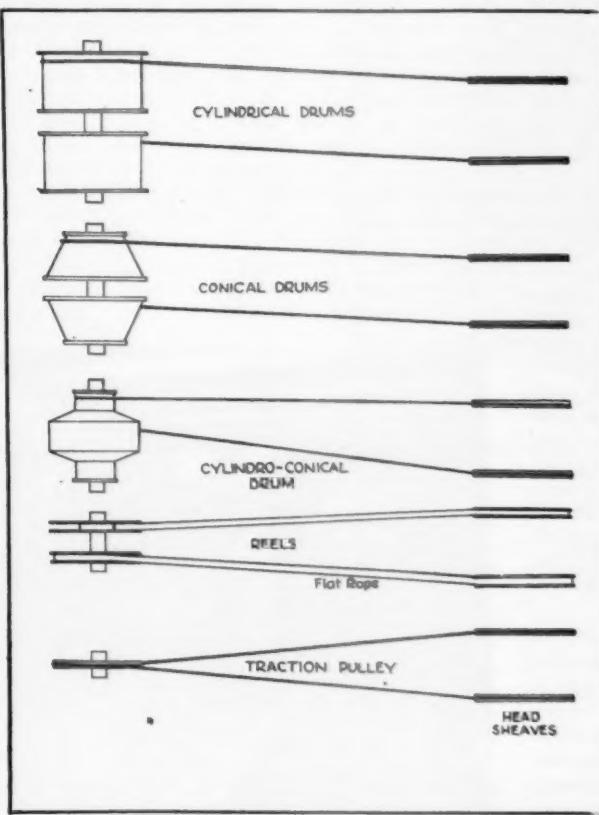
While there is such great variation in types of mine hoists and conditions of operation that it would be impracticable to present examples of all, the fundamentals will be explained and calculations will be carried through on several hoists typical of the more common form, which may be used as a guide to other problems which might arise. For those not entirely familiar with mining conditions and to clarify what is to follow it is thought advisable to describe briefly the different forms of equipment used and to mention some of the limitations in operation.

Mine hoists may be divided into two general classes:

(1) *Slope Hoists*—Where

the mineral deposits outcrop at the surface, frequently the case in coal seams, and where the topography, land holdings, transportation facilities and other conditions favor the location of a surface plant at or near the outcrop, the mine is opened by a drift starting at this point and following the general dip of the seam. In many cases the seam lies nearly horizontal so that the mine cars may be hauled by locomotives the entire distance to the surface, but long hauls and grades averaging more than about 5 percent, locomotive haulage becomes uneconomical since too great a percentage of the locomotive tractive effort is required to haul its own weight. When this condition exists rope haulage is used on the main entry, from which the workings are entered by side drifts having grades suitable to the use of gathering locomotives which make up trips of loaded cars to be hauled up the slope by a hoist on the surface.

Slope hoists usually operate unbalanced, that is the trip of loaded cars is hoisted to the surface without any form of counter-balancing and after a short delay for changing couplings a trip of empty cars is lowered back into the mine. As hoists of this type frequently run to great distances, often as much as a mile or more, and as hoisting speeds greater

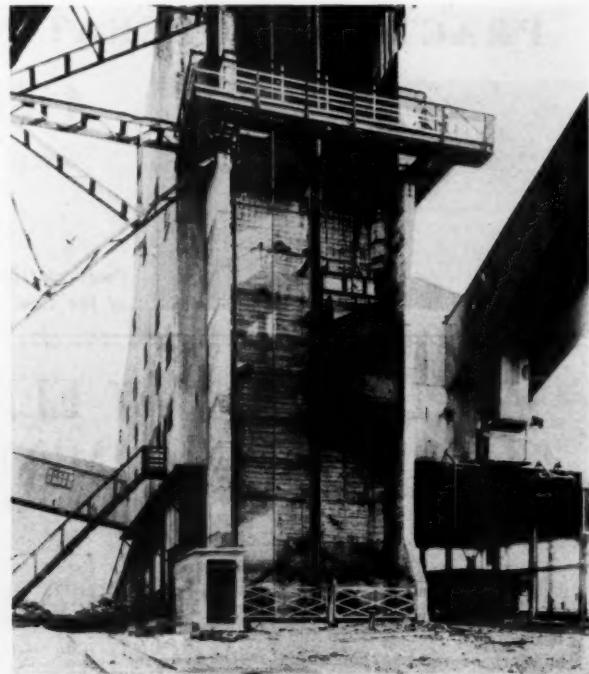


Forms of mine hoists in common use

\* General Engineering Department, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.



*Headframe and tipple of coal mine using self-dumping cage. Hoist is of the end lift type*



*Overshadowing skip used in large tonnage coal mine hoist*

than 1,500 feet per minute are seldom used, only when the track and cars can be kept in first-class condition, trips of a large number of cars are necessary when a moderate daily tonnage is to be produced. A fairly large motor is sometimes required for such service, therefore, where the combination of trip weight, grades, and hoisting speed are great.

(2) *Shaft Hoists*—In the great majority of cases the mine hoist operates through a vertical or inclined shaft sunk from the surface to the underground orebody or seam, which is developed through horizontal drifts, leaving pillars of sufficient size to support the shaft. Metal mines are usually worked from a number of levels at a time, lower levels being developed as the upper are exhausted and in a few cases coal is taken from two or more overlying seams at the same time. As a rule, however, coal is mined from only one seam at a time and the majority of coal mine hoists accordingly operate from only one level. The hoist design is influenced by these conditions as explained later.

The mine shaft is ordinarily of rectangular sections, timbered or concreted to support the strata through which it is sunk and provided with guides for the skip or cage. Separate compartments are usually provided for the hoist, dewatering pipes, power cables, air-way, man-way, etc. Not all of these are present in every case, of course, but metal mine shafts which run to great depths

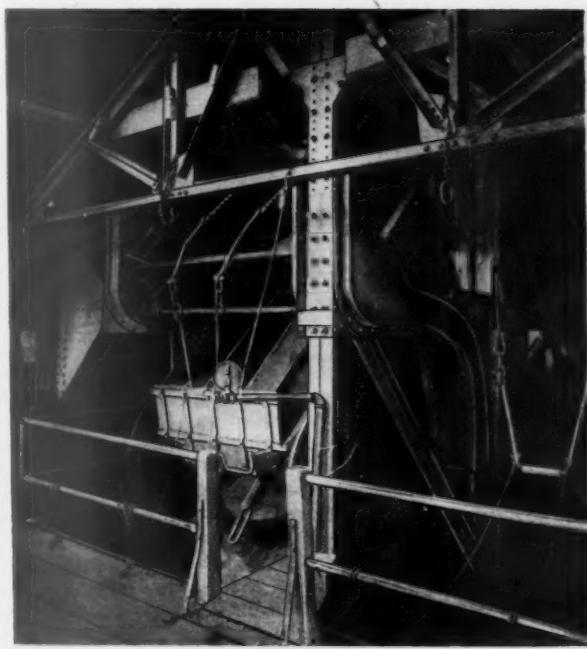
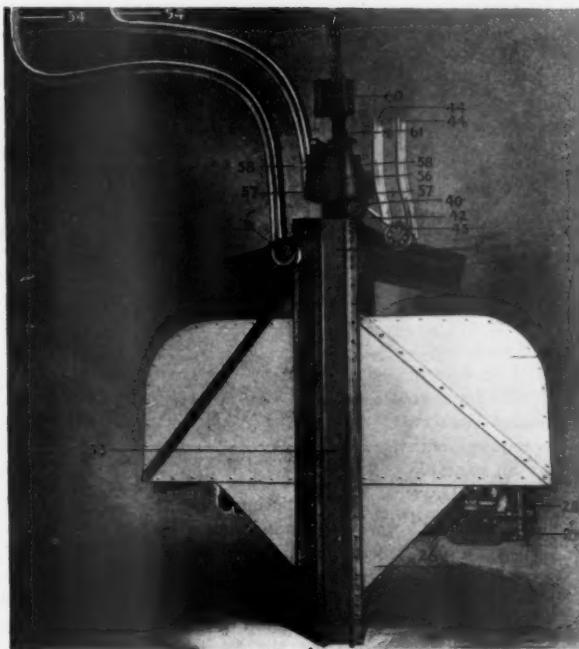
are frequently constructed with five or six compartments. As it is desirable to avoid interference with production of the main hoist as far as possible, a separate man and material, or "Chippy" hoist is usually installed to handle men, supplies, drills, locomotives, etc., between the surface and the various levels. In metal mines the main and "Chippy" hoists are nearly always run in separate compartments of the same shaft, but in coal mines for reasons of safety, ventilation, etc., a separate shaft is practically always sunk for the supply hoist.

In many cases the mineral is hoisted without removing it from the cars into

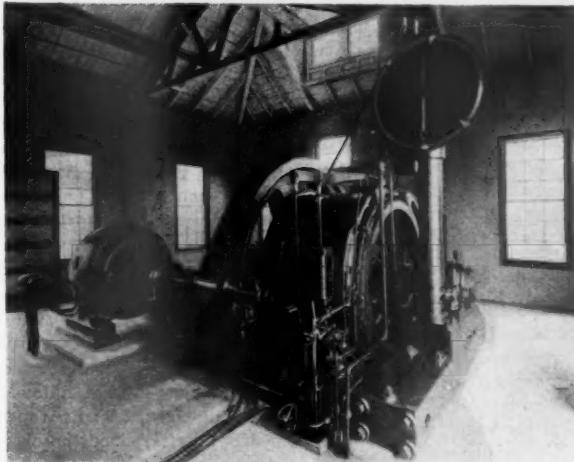
which it was originally loaded, the cars being hauled in trains to the shaft bottom or level, where they are uncoupled and run onto the hoist cage. The usual practice in cage hoisting is to raise a single car at a time, but in metal mining, where the shafts are comparatively deep and cars of small capacity, multi-deck cages are frequently used to handle several cars at each hoisting trip and thus secure a moderate daily tonnage with reasonable hoisting speeds. With this type of construction it is necessary to shift the hoist a number of times during the caging period to load the successive cage decks. Hoists of this sort



*Shaft bottom—Hoisting with self dumping cages in balance. Cager is giving signal to start to hoistman on surface*



*Manufacturers catalogue cuts of self-dumping cage and self-dumping cage in horns*



*Coal mine hoist using single cylindrical drum*

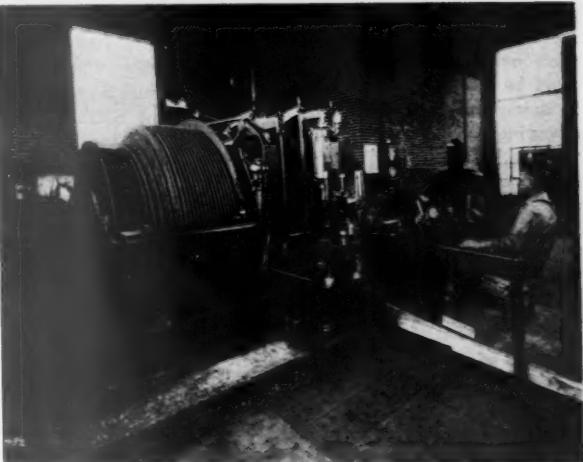
have been installed with elaborate caging devices to load as many as four decks at a time and thus avoid shifting of the cage during the loading period, but such construction is hardly practicable for more than one level.

#### CAGES

Mine hoisting cages are of two general forms:

*Platform Cage*—The simplest form of construction consists of a suspension member or bale and guides carrying a horizontal platform with rails onto which the loaded car is run from the mine track and held by a locking device while it is being hoisted. This requires replacing the loaded car with an empty

at the top and the empty car with a loaded one at the bottom during the interval between hoisting trips. Depending upon the production desired and the speed of operation necessary, various delay times are allowed for caging with this type of equipment, the minimum time being approximately 4 seconds, and usual values in the neighborhood of 8 or 10 seconds. The platform type of cage is used extensively for ore hoisting in metal mining service where conditions do not favor the use of skips and in coal mining service particularly in the anthracite field. For the main hoist the cages are almost always operated in balance, that is, the weight of cage and car in which the load hoisted is counter-



*Hoists for deep metal mine using double cylindrical drums with clutches*

balanced by the empty cage and car lowered in a parallel shaft compartment, this operation being reversed at each cycle.

Cages used for man and material hoists are always of the platform type and when operated in a shaft compartment along side the main ore hoist, as in metal mines, where there is danger from falling rock the cage is frequently enclosed on all sides with heavy sheet metal.

Self-dumping cages are used frequently in bituminous coal mining and to a certain extent in the anthracite field. This type of cage is designed to dump the car at the surface without removing it from the platform. Self-dumping

cages are made by a number of different manufacturers in a variety of sizes and weights, and while there is marked difference in details, the fundamental construction is much the same. Two frames are used, the outer suspended from the rope and running in the shaft guides has pivoted to it at the bottom an inner structure carrying a platform on which the car is held by a device which usually clamps the wheels. When the cage in hoisting reaches a position near the dumping point a roller on the inner frame engages a specially curved guide, causing the platform to be tipped forward to an angle of approximately 45 degrees as the outer frame is moved vertically in the main guides. Cars used with this type of cage have a lifting or swinging end gate, so that as the cage is tipped the end gate is unlatched, allowing the coal to dump out into a receiving hopper.

The advantage of this type of cage is in the saving in labor and time at the dumping point, since no provision is necessary to handle cars, which remain on the cage and return empty to the mine on the following trip. The self-dumping cage has been applied extensively to large capacity coal hoists where fast operation is necessary, frequently making from three to four trips a minute. On such hoists, where the complete cycle must be made in from 15 to 20 seconds, it is imperative that the delay time for changing cars on the bottom cage, or "caging," be as short as possible, as a difference of a few seconds in the available running time greatly affects the hoisting speed and power requirements. Systems of caging accordingly are carefully worked out, and in some instances the average caging time has been lowered to as little as two and one-half to three seconds. To assist in keeping the delay time as small as possible the "slack-rope" system is occasionally used, landing the bottom cage before the loaded cage has been pulled into the final dumping position, so that the caging operation can be started before the hoist has come to rest. This is often considered objectionable, however, because of the additional stresses thrown on the hoisting rope when the slack is taken up during acceleration.

#### SKIPS

Conditions in metal mines generally require the use of small capacity cars, holding in the neighborhood of 1 ton or less, and as such mines frequently hoist from great depths it is necessary to handle a weight of ore equal to a number of car loads if a moderate tonnage is to be produced with practical rope speed. As previously mentioned, this is sometimes done by the use of multideck cages, but the usual practice is to hoist in skips holding from 1 to 12 tons, which are loaded from ore pockets at the various mine

levels. The use of skips permit the cars to be designed entirely to suit mining conditions and the hoisting plant for efficient hoisting. Where ore is hoisted from a number of different levels, the loading pockets are made of sufficient size to provide for storage to avoid the necessity of changing the hoist from one level to another frequently throughout the day.

While skip hoisting has been practiced most extensively in metal mining it has in comparatively recent times come into favor for large capacity coal mines where it would be impossible to hoist the desired tonnage in self-dumping cages with practical rope speed. By hoisting several carloads in each skip the daily tonnage can be handled with greatly reduced hoisting speeds and power requirements are materially lowered. As an example might be mentioned the case of a large tonnage coal mine, which has produced upward of 15,000 tons in an eight-hour shift, hoisting a distance of 607 ft. with two skips in balance designed for a maximum load of 13 tons. This hoist is designed for a rope speed of 4,050 ft. per minute, which approaches the limit of present hoisting speeds. It is apparent that the production of this great tonnage would hardly be practicable with lighter skip loading.

Two distinct types of skip are in use for mine hoisting, i. e., the over-turning and the bottom-dumping. The over-turning skip has long been used in metal mining and has been applied to some extent in coal mining, where somewhat special shapes have been developed to reduce breakage of coal during loading. This type of skip is pivoted to a hoisting bale, which is held rigidly in a vertical position during hoisting and at the dumping position the skip is overturned by the engagement of rollers with curved dumping horns. In the final dumping position a certain part of the skip weight (30 to 50 percent) is supported on the horns, so that the full weight of the empty skip is not effective for counterbalancing until it has moved back out of the horns.

The bottom dumping skip has a bottom sloping at a steep angle to a gate, which is held closed by latches or levers during hoisting and dropped at the dumping position to allow the coal to pour out the bottom. Various advantages are claimed for the two types of skip, but a discussion of this question is beyond the scope of the present article.

Although most hoists operate in balance so that the weight of cage and car or the skip in which the material is hoisted is counterbalanced by an equal weight descending empty in another shaft compartment, it is usually desirable to keep these parts as light as possible consistent with the required capacity and strength, since the entire mass must be accelerated and decelerated at the begin-

ning and end of each hoisting trip, which sometimes adds considerably to the power requirements. In general, however, the design of these parts is made largely to suit mining conditions and to provide the necessary strength. There is no fixed relation between the weight of load and that of the container. The following table gives the approximate average values of a large number of examples, but in individual cases the proportion may vary as much as 50 percent above or below the values given:

Weight of load	Weight of car	Weight of platform cage	Weight of skip	Material
100	50	3000 + 0.8L	..	Coal
100	..	.....	60	Coal
100	..	.....	70	Ore

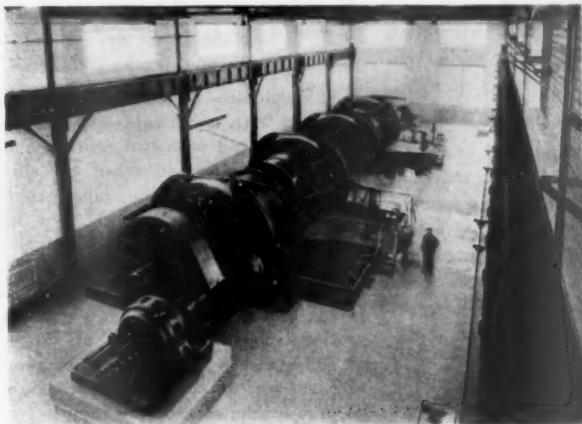
#### ROPES

Mine-hoisting ropes are practically always of round stranded steel wire, American practice favoring the 6 x 19 strand, which consists of 6 strands each made up of 19 steel wires twisted about a core of hemp or other material serving to retain the lubricant, which must be applied at intervals to prevent corrosion or excessive wear. Steels of several different grades are employed, but that known to the trade as "plough steel" is in most common use. A number of forms of flatten strands and locked coil ropes have been developed by various manufacturers, using wires of special shapes in the strand to secure a higher total strength for a given rope diameter, and while such construction has been used extensively abroad their application here has been very limited.

The weight and breaking strength of various sizes and grades of hoisting rope are given in bulletins of the rope manufacturers. The factor of safety to be used depends upon conditions of service. It is generally considered that a lower factor of safety can be used with ropes operating in deep shafts, since the elasticity compensates somewhat for extra rope stresses during acceleration. Various states in their mining laws define the minimum factor of safety which should be used, the bituminous mining laws of Pennsylvania for 1924, for example, stating that for hoisting men the factor of safety shall be not less than 10 to 1 and for hoisting material exclusively not less than 5 to 1 of the maximum load. Such regulations, however, seldom take into account the additional rope stresses imposed by acceleration, which may be amplified by vibration of the rope, and for hoists operating at a fast rate of acceleration consideration should be given to these extra rope stresses.

#### DRUMS

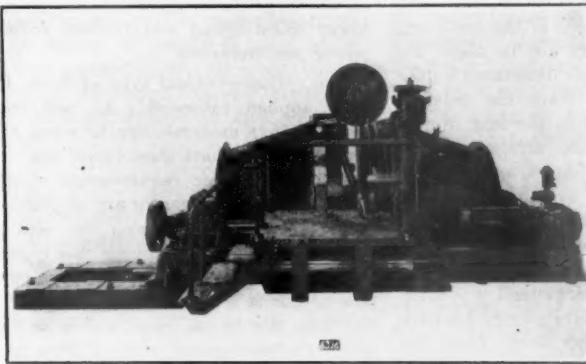
In mine hoisting the usual arrangement is to have the rope attached se-



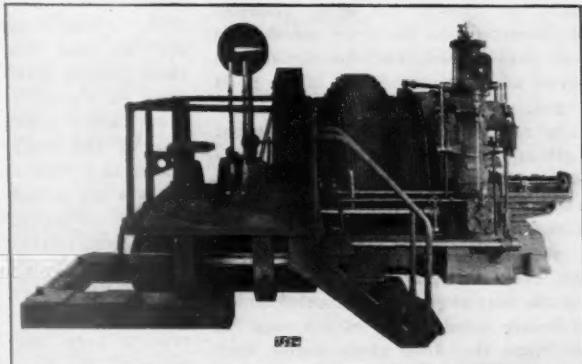
*Hoists for deep metal mines using double cylindrical drums with clutches*



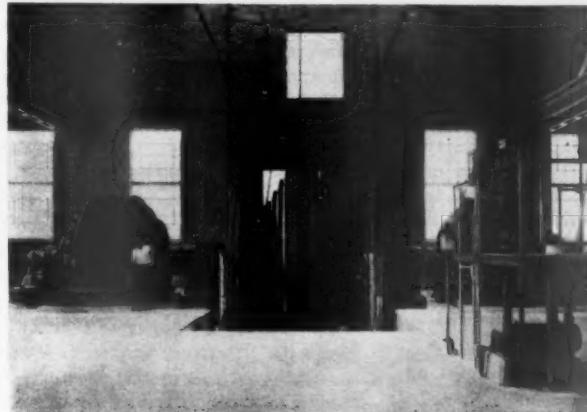
*Coal mine hoist of side lift type using double cylindrical drums without clutches*



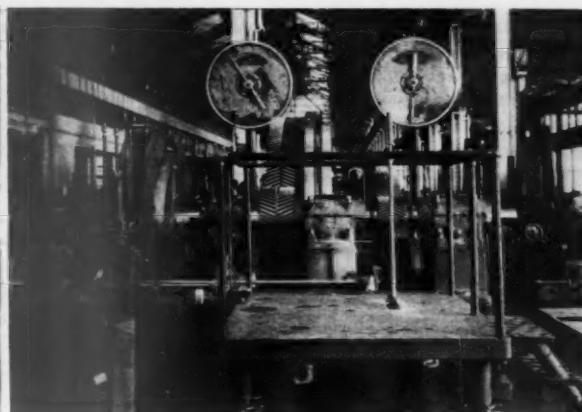
*Conical drum hoist on manufacturer's assembly floor*



*Cylindro-conical hoist on manufacturer's assembly floor*



*Large capacity cylindro-conical hoist in coal mine service*



*Bottom pulley hoist for deep metal mine service*

curely at one end to the cages or skips and at the other end to the hoisting drums, which are usually mounted at or near ground level, the rope speed carried over sheaves on the head frame surmounting the shaft. The head sheaves are usually at a sufficient distance above the dumping point to minimize the danger of wreck in case of overwind. Mining laws require a certain number of inactive or "holding" turns on the drum,

the exact number required varying in different localities, but is usually not less than three.

In the great majority of hoists the drums are of the familiar cylindrical form, either of cast iron, cast steel, or built up of cast spiders with a shell of heavy steel plate. The face of the drum is usually grooved to assist winding the rope evenly.

From the standpoint of power require-

ments it is desirable that the hoisting drum be as small in diameter and as light as possible consistent with strength, since the drum inertia usually amounts to a considerable portion of the total inertia of the system and a saving in this quantity lowers the torque required during acceleration and deceleration. On the other hand, however, there is a fairly well-defined minimum ratio between the drum diameter and the rope

diameter below which bending stresses in the rope become excessive and the rope life is shortened. For the 6 x 19 rope this ratio is ordinarily taken as 50 or 60 to 1, and it is generally considered better that, if possible, the ratio be not less than 75 to 1.

In certain mining districts it is considered objectionable to wind more than one layer of rope on the drum because of the crushing and increased wear of the underlayers, and for deep mine hoists drums of very large diameter are sometimes employed to wind the necessary length of rope in a single layer. With motor drive excessive drum diameter is objectionable, not only because of the added forces required during acceleration and deceleration, as previously mentioned, but if a direct-connected motor is to be used, frequently the case on large hoists, the greater the drum diameter the slower will be the drum speed for a given rope speed, and consequently a heavier and more expensive motor must be used.

The requirement of winding a great length of rope in one layer is sometimes met by the use of drums of moderate diameter and wide face, the hoist being set back as much as 500 or 600 ft. from the shaft and the ropes carried to the drum over idler pulley stands so as to keep the fleet angle within a value which will insure even coiling of the rope on the drum—the fleet angle being that made by the rope at one end of the drum with a line to the center of the drum and the head sheave.

In some sections the life of the rope is so shortened by acidity of the mine water to which it is exposed in the shaft that the added wear caused by winding in more than one layer is considered of little importance, and here the practice is to use drum diameters only large enough to limit bending stresses and wear of the rope to reasonable values, winding in two or more layers is necessary. Slope hoists operating over long distances frequently wind as many as five or six layers of rope on the drum, as the rope wear from this source is light compared to that in running over track rollers, which are difficult to keep in good condition.

While the cylindrical drum is in more common use, various special shapes are frequently employed on balanced hoists for the purpose of securing a greater counterbalancing effect of the empty skip or cage at the start of the cycle and thus reduce power demand during the accelerating period. This is accomplished by having the rope to the empty skip or cage unwind from a small diameter during the accelerating period, going more or less gradually to a larger diameter as full speed is reached. Several of the drum shapes in common use are illus-

trated by the accompanying sketch and installation views and a brief description of their construction and application follows:

#### CYLINDRICAL DRUMS

The cylindrical drum is used in practically all metal mining hoists on this continent where operation is from a number of levels, since the advantages of better equalization of the special drum shapes can not be secured for more than one level unless the levels are very close together compared to the total hoisting distance. When winding from one level a single drum can often be employed for both ropes, one of which is unwound as the other is wound, the two ropes following each other across the face of the drum. This is the case for "end-lift" hoists where the drum is set in a line with the long dimension of the shaft and the two head sheaves are in about the same vertical plane, as illustrated by the hoist in Figure 1. When the hoisting drum face is parallel to the long dimension of the shaft, the arrangement is known as a "side-lift" hoist, and the head sheaves are mounted at the same elevation, but are separated horizontally a distance equal to the space between centers of the two parallel hoisting compartments. With this arrangement it is often necessary to use a separate drum for each rope to keep the rope angle from the drum to the sheave within a desirable value.

With hoists operating from several levels it is the usual practice to provide one or both drums with clutches to permit adjustment of the ropes for the level from which it is desired to operate, which will be necessary more or less frequently during each hoisting shift. This may be accomplished by unclutching the drum holding the upper skip in the dump, leaving the brake on this drum set and raising or lowering the skip in the shaft to the desired level after which the clutch is reapplied. This operation leaves the two ropes at proper length for balanced operation from the level desired.

Although most hoists of this part operate in balance, it is usually specified that the power equipment be capable of operating for short periods out of balance in emergency, so that production need not be entirely stopped in case of trouble with one side of the hoist.

#### CONICAL DRUMS

The conical drum was one of the shapes first developed to secure better counterbalancing at the start of the cycle by suspending the empty skip or cage from a smaller diameter than that for the loaded cage. The application of this type of drum is now rather limited on electric hoists, as it is not quite so effective as

the cylindro-conical drum, a later development.

#### CYLINDRO-CONICAL DRUM

The cylindro-conical drum is usually designed with a central section of large diameter joined with two cylindrical sections of smaller diameter by conical frustum on which the rope grooving takes the form of a spiral. The number of turns on the various portions are usually chosen so that during the accelerating period the empty skip or cage is suspended from the small cylindrical section, reaching the base of the cone as full speed is reached and the number of turns on the cone are made as small as practicable, so that the rope is transferred to the large diameter as quickly as possible. With this design as much as possible of the full speed winding is done on the large diameter, which results in a lower drum speed and further reduces power requirements.

The cylindro-conical type of drum has been applied extensively to coal mine hoisting from moderate depths where fast operation and short duty cycles are necessary and power requirements during acceleration consequently are of greatest importance in determining the size of motor. As hoists employing this type of drum operate from comparatively shallow depths it is not so urgent to provide for long life in the rope, and it is frequently advantageous to use a drum having a diameter of the small cylindrical section, having a ratio to the rope diameter less than is ordinarily considered advisable. Cylindro-special conditions, but drums of the following proportions have been applied in a number of cases and one of these can usually be chosen to suit most requirements.

Minimum diameter Feet	Maximum diameter Feet	Turns on cone
4 1/2	6	2
5	8	3
6	8	3
6	9	3
7	9	2
7	10	3
7	11	4
7	12	5
7 1/2	10 1/2	5
8	11	3
8	12	4
9	12	6
10	17	3.5

#### REELS

The reel type of hoist has been applied to a limited extent in metal mining service, employing two narrow reels winding flat rope made up of a number of round ropes sewed together, winding starting at a small diameter and increasing as the rope piles up on the reel with each successive turn. This type of hoist is somewhat similar to the conical drum as to the counterbalancing effect and has the advantage of very low inertia of rotating hoist parts, since the reels are of very

light weight compared to drum construction. The application of this type of hoist has been limited because of the high cost of rope and repairs.

#### TRACTION PULLEY

A system of hoisting used extensively in Europe is that known as the "Koepe," using a large, single-groove drive sheave with one rope passing around the sheave and making contact with about 200 degrees of the periphery, the two ends of the rope being attached to the skips or cages. The advantages of this system are in the low inertia of the rotating hoist parts, which consist of only the drive sheave, head sheave, and necessary gearing and brake rig.

The "Koepe" system has not been applied in America, but a single groove, traction type of hoist, has recently been brought out, having the same advantages of low inertia. This type of hoist, which has been applied in several cases, uses a specially constructed groove designed to grip the rope in case of any tendency to slip.

#### FUTURE of NON-METALLICS

(From page 33)

navia I thought I would get a different reason from what I got in the South. I noticed that in the town where I was every house in view was a fisherman's house and every house had a tile roof. I inquired why, and they said, "For winter." They said, "A time will come when we will not see the sun for six weeks, and on the tile roof there will be one meter of snow all winter."

Down in Spain it is the permanent roof! and if there is one country that is 100 percent under a tile roof I think it is Spain.

In France an architect said, "Tile expresses art, beauty." They are very appreciative of art and style.

It was over in England that I got the best reason, and it comes the nearest in its application to America. I said to an English architect and an English engineer, "Why do you use tile?" In Wales they use slate and in Scotland they use stone. I was told that years ago there was a man called William the Conqueror, and he conquered them and put them to work, and they had to have better buildings in which to take care of their crops and houses for their increasing families. They said, "We took the nearest good natural material, treated it artistically and made our homes appear like they grew out of their environment." And there is your burned clay brick building, with the most wonderful chimneys.

Then when you come across to America you can visualize the pioneer cutting the wood with his adz and ax, and there came

forth the log cabin and the hand-hewn wooden shingle.

Then we swapped surplus tobacco for Cornwall tin, and your early colonial houses will show wonderful unadulterated thick tin roofs that have served for all these years.

Then some ingenious fellow devised a means of getting slate, and it was not until about 60 years ago that any American was sufficiently ingenious to go into the commercial side of burned clay. Our country is so young. But now we are reaching a stage of economic independence. We are reaching a state of wide travel, a state of appreciation of the beautiful and the permanent, until there is an ever-increasing demand for burned clay.

You can find today burned clay in foundations, in floors, in the most charming places; and what I noticed in the Shakespeare home was that the fireplace, the walls, the floors, as well as the roof, were of burned clay; and I thought to myself, being in the burned-clay business, "William Shakespeare's parents had good taste!"

So that burned clay is coming now as the wood age is going out, and the time is coming when wood will be difficult to obtain for even the frame, because good old heart stuff is getting scarcer and scarcer. But a benevolent and kind providence has furnished us an unlimited amount of raw material for burned clay. It is indissolubly linked with the other necessary—coal.

In all my research I have never found but one place where they were using an electric oven for clay products. That was across the river from Trenton, N. J. Even then the product itself was burned with coal, and only the beautiful delicate glaze was put on by electricity by traveling on a car through an electrically heated combustion chamber.

This empire to the south of us, that lies from here to the Rio Grande—I can make several comments in closing, because having gone out of the territory north of the Potomac to the territory between here and the Rio Grande, it leads me to make several conclusions as to its growth, and out of those conclusions you can draw your vision of the future of the ceramic industry and of the nonmetallics.

In the empire lying from here to the Rio Grande, comparing the year 1900 with the year 1927, you have an increase in population of 46 percent. (We will have 346 percent.) In manufactured products we have increased 563 percent; in mineral production, an increase of 1,452 percent; coal, 401 percent; petroleum, 3,204 percent; bank deposits, 960 percent; highway expenditure—and all you need to do is to travel over that great "Tarheel State" of North Carolina and you become convinced that

they have spent their money well—3,157 percent; public schools, 1,116 percent.

Having knocked around the world and visited every continent but Australia in the study of ceramics, I want to tell you that there comes a time in every man's life when he receives a thrill; and there is one building in all America of ceramic material that gave me the greatest thrill, rather than any place in some foreign country, and for an hour or so I rambled about it and then I looked up and saw emblazoned these words:

"Thermopylae had her messages of defeat; the Alamo had none."

Men of America, you can be proud that you have within the Union an empire that can produce men that can have an encomium like that in the Alamo at San Antonio, Tex., said of them, and have them back in the Union 100 percent.

#### TESTING EXPLOSIVES REDUCES HAZARDS OF MINING

It may be taken as an axiom that no explosives are wholly safe or "fool-proof," but the Pittsburgh Experiment Station of the Bureau of Mines is continually striving by testing and research to increase the margin of safety for the user of explosives. The bureau maintains at Bruceton, Pa., a completely equipped testing and research station where explosives are tested to determine their permissibility for use in gassy and dusty coal mines and their suitability for other mining and engineering uses.

Various types of apparatus have been devised to measure the properties of an explosive which determine its suitability for a given operation. A newly designed piece of apparatus photographs the pressure waves sent out by a detonating explosive and gives an indication of the effect of these pressure waves in causing ignitions of the inflammable mixtures found in coal mines. There are now 135 explosives on the list of explosives permissible for use in coal mines, all of which have passed satisfactorily the bureau's tests for safety and suitability.

All samples of explosives submitted for permissibility tests, samples submitted for special tests, and samples collected in the field are analyzed chemically.

The Explosives Section of the Bureau conducts physical tests on the explosives used in field tests, in order that the exact physical characteristics of the explosive can be coordinated with the field results.

The unit deflective charge, rate of detonation, and gaseous products of explosion have been determined on samples of various grades of dynamite manufactured by four different companies. The data will be published as a technical paper showing the relative strength and other properties of commercial grades of dynamite.

## PRACTICAL OPERATING MEN'S DEPARTMENT

### METALS

GUY N. BJORGE

*Editor*

*Practical Operating Problems  
of the Metal Mining Industry*



## NEW ELECTROLYTIC ZINC PLANT of SULLIVAN MINING COMPANY

By RAYMOND M. MILLER \*

HERE is probably no metallurgical enterprise today that has been watched with as much interest by the public and the profession as has the building of the Sullivan Mining Co.'s new electrolytic zinc plant at Silver King, Idaho. This is, no doubt, due to the fact that it is the first industrial plant using the Tainton high acid, high current density electrolytic zinc process, though an experimental and pilot plant has been operating for years producing zinc of exceptional purity.

The new plant has been built near the head of Government Gulch at Silver King, Shoshone County, Idaho, in the Coeur d'Alene mining district, 1 mile distant from the Bunker Hill and Sullivan smelter and 3 miles from Kellogg. The site is ideal for gravity flow. The main building rests on the hillside, which has a slope of

*This Plant Is First Industrial Plant Using The Tainton High Acid, High Current Density Electrolytic Zinc Process—Recent Assay Of Cathode Zinc Now Being Obtained Shows A Purity Of 99.994 Percent*



about 17 degrees, while the cell, cooling, generator, and melting buildings are located on the flat just below. A spur of the O. W. R. & N., passing through the plant yard, furnishes transportation facilities.

The present unit has a nominal capacity of from 60 to 75 tons of cathode zinc every 24 hours, and has been so built that two additional units may be ultimately added. Its feed will be derived from the flotation concentrates of the complex lead-zinc ores of the district and its surrounding territory, as well as from the Star mine, a property owned by the company.

#### FACTORS INFLUENCING THE SELECTION OF THE PROCESS

Zinc electro-metallurgy, from the beginning, has been afflicted with serious inherent difficulties, which have threatened the process with economic extinction. The roasting of zinc sulphides in intimate contact with iron tends to produce zinc ferrite,

\* A. I. M. E. Assistant Metallurgical Engineer, Sullivan Mining Company, Kellogg, Idaho.

Fig. 1. Site of the plant in October, 1922  
Fig. 2. View from the same point as Fig. 1, taken 22 months later



Fig. 3. From hillside near the Cottrell Plant

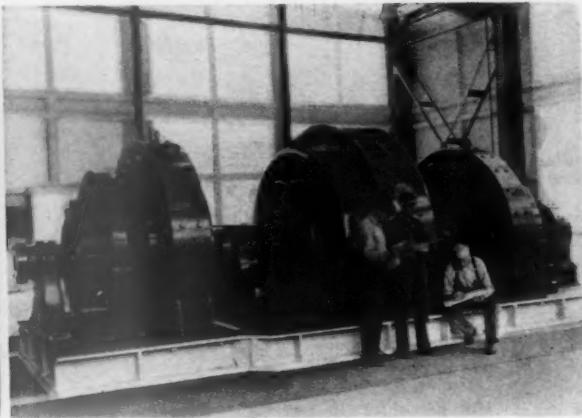


Fig. 5. One of the generator sets

which is insoluble in dilute sulphuric acid, with the result that zinc so combined will be thrown into the leach residue. The leaching of calcines in sulphuric acid solution not only dissolves the zinc oxide but takes into solution also quantities of iron and silica, which, when the leach is neutralized, are precipitated as ferric hydrate and gelatinous silica, both of which make filtration difficult. The presence of certain impurities in the electrolyte, even in minute amounts, seriously interferes with electro-deposition, and these must be removed. The above and numerous other problems have been experimented with by many notable investigators and solved with various measures of success.

Present practice at plants now successfully extracting zinc electrolytically from sulphate solutions makes use of dilute sulphuric acid in the leach, and a low acid electrolyte, in combination with a low current density in the cells.

Tainton's experiments have shown that a high acid electrolyte and a high current density in the cells will give, particularly in the presence of certain colloids, a smoother deposit of zinc on the cathode with a higher current efficiency. This permits the use of a high acid leach in which zinc ferrite produced in roasting is soluble. Due to this fact, roaster temperatures need not be so carefully controlled and greater capacity per roaster, with attendant increased extraction of zinc, results. A greater concentration of zinc in the neutral solution reduces the total amount of solution to be handled per ton of zinc produced, and makes possible the presence of greater amounts of impurities per liter. In addition to this, the higher current density in the cells produces a correspondingly greater amount of zinc per unit of time and cathode area than is the case with the low current density, permitting a smaller cell unit for the same output of

zinc. A fuller discussion of these points may be found elsewhere.\*

It may be sufficient to say here that the advantages of the high acid, high current density process have been recognized by many metallurgists, but its special problems and disadvantages have required extensive experimentation on the part of investigators and the ingenuity of Tainton and his staff for their final solution.

#### DESIGN AND CONSTRUCTION

The experimental work which has culminated in the building of the plant, as well as the construction, has been initiated by and carried on under the management of Stanly A. Easton, vice president and general manager of the Bunker Hill and Sullivan Mining and Concentrating Company. Construction has been under the direction of Walter K. Mal-

lette, superintendent of construction. Daniel Bosqui, U. C. Tainton and Wallace G. Woolf are responsible for the flow-sheet and metallurgical design.

A large number of the machines have been specially designed for their purpose, a staff of 15 designers and draughtsmen having been retained during the period of the building. Practically all building was done by contract, most of the excavation, however, being day labor in charge of the company foreman. An average of approximately 250 men were daily engaged in construction work.

The first work on the building began in October, 1926, and the first roaster was started in August, 1928, 22 months later. Nearly 13,000 cu. yds. of 1:2:5 concrete went into walls, foundations, floors and piers, requiring 78,000 sacks of cement, 344 cars of mill tailings, and 167 cars of sand (table tailings); 506,000 pounds of reinforcing steel were used. The framework of the principal buildings is entirely of structural steel. The walls are of gunite, supported on the steel framework by 4 x 6 in. wall girts and posts and reinforced with triangular mesh wire. One part cement mixed with two and one-half parts of sand is forced through a hose and nozzle from a pressure chamber, and sprayed with water, onto the wire reinforcing, which is backed up with shiplap. After removing the shiplap the other side was sprayed, giving a wall thickness of 1½ in. Wall girts and posts are completely covered and thus made fireproof. All roofs are laminated—2 x 4 in. on edge, nailed to rafters which are bolted to the steel roof trusses. Every 2 ft. is placed a 2 x 8 in., the whole being solidly nailed together so that each 2 ft. section acts as a T-beam. The designed strength of this type of roof is 45 lbs. to the square foot. Accumulation of ice and snow, however, during the past winter subjected parts of the roof of the main building to a load approximating 250 lbs. a square foot.

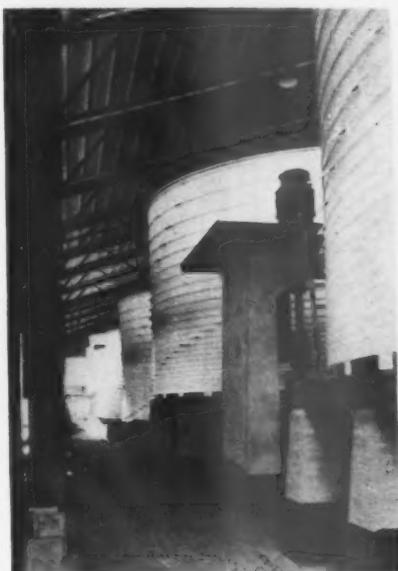


Fig. 4. Storage tank floor showing electrolyte tanks and acid pump in the foreground

\* U. C. Tainton and L. J. Leyson, Transactions, A. I. M. E., Vol. 70, p. 486.



Fig. 6. The Reservoir, W. W. P. switching station and change house for employees under construction. Office and residences of the officials

without serious injury. Roof covering is of asphalt impregnated burlap. Windows take up about 25 percent of the wall area.

**The Main Building**—The main building is 216 ft. wide by 306 ft. long, covering an area of a little over an acre and a half. The sloping site permits gravity flow of the solutions and pulps through the various operations, requiring a minimum number of pumps. This building is divided into five floors—the top being the roaster floor, and successively lower are the leach floor, filter and purification floor, storage tank floor, and residue drying floor. All floors are of concrete, and have a slope of about 1 in. in 6 ft. for drainage. Those sections under acid tanks are painted with asphalt in case of spillage. All tanks and machinery are mounted on concrete piers, and individual motor drive with speed reducer for all machines is used as far as is practicable.

**Cell Building**—The cell building, on the flat, is 57 ft. wide by 280 ft. long. The cells, on the main floor, are supported on timber framework, which rests on concrete piers in the basement, and are arranged in four rows of 75 cells each. Directly under each row there are the discharge sumps and directly above are cell launders. All are of wood and are lead lined throughout. The operating floor is of wood.

**Generator Building and Equipment**—The generator room adjoins the cell room on the south, and is 54 x 57 ft., the foundations, basement, and main floors being built entirely of concrete. The structure is of steel and gunite. All conduit has been laid in the concrete floors.

Generating equipment consists of two synchronous motor generator sets, each with a rated output of 8,000 amperes at 500 volts. Two generators are direct connected to a 5,600-hp., 4,400-kv. a., 2,300-volt, synchronous motor. Both the motor

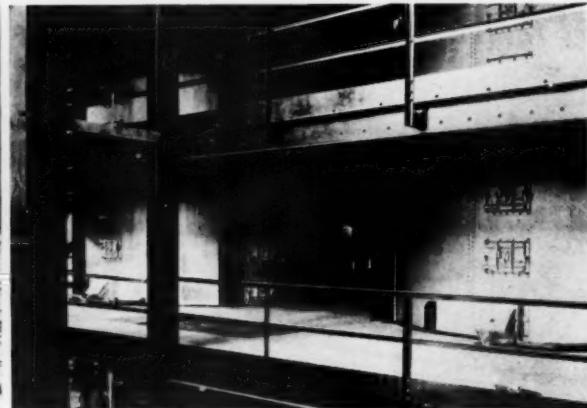


Fig. 8. Roasters are painted with aluminum paint. An auxiliary oil burner is shown on the hearth

and generator fields are excited by a direct connected 125-volt, 43-kw. exciter. These sets are mounted on reinforced concrete foundations resting upon heavy concrete pads. Cooling air is passed through washers to remove any traces of acid or dust before admitting it to the generators. A 25-ton Whiting traveling crane is mounted above the sets.

**Office and Laboratory**—These are up-to-date brick structures. The office is a two-story building containing the offices of the officials and the accounting and engineering staffs. Spacious reinforced concrete vaults were built for the records of the plant, and large, well-lighted rooms provide for the draughting and metallurgical accounting force.

The laboratory is exceptionally well equipped. A wet room has four large

steel hoods with hot plates and double benches for chemical analysis. Another room contains equipment for electro-analysis. The fire assay room contains two oil-fired muffles and a parting room in connection. The balance room is well lighted, and all balances are mounted on concrete piers which have no connection with the building, thus eliminating vibration. Reinforced concrete vaults are provided for sample storage.

Six modern five and six room residences have also been built for officials of the plant.

**Plant Water Supply**—To insure a supply of water for solutions, electrolyte cooling, and other requirements, three wells have been sunk in the Coeur d'Alene River Valley, 1½ miles below the plant. These were dug with a crane, an orange peel bucket and considerable patience. Casing is ½-in. steel plate, 5-ft. sections, 6 ft. in diameter. Depth of wells averages 82 ft. Heavy ground made digging difficult. Water is pumped from the wells by three Byron Jackson deep-well turbines to two Byron Jackson, two-stage centrifugal, 1,500-gal. capacity booster pumps. These are driven by 200-hp. motors and pump to a 1,500,000-gal. capacity reservoir at the plant against a discharge head of 310 ft.

The reservoir was built of reinforced concrete, cantilever type walls, 16 in. wide at the base. To allow for expansion lead joints were placed between 50-ft. sections. Each section was poured monolithically. The floor is concrete reinforced with heavy triangular mesh wire. Slope is toward one corner, to the outlet and drain pipes. The size of the reservoir is 150 x 150 ft. x 10 ft. 6 in. deep. During the wet season a creek, which has been diverted to the reservoir by a long culvert, will supply all the water that is necessary. This can be either run into the reservoir or bypassed in a spillway built around the

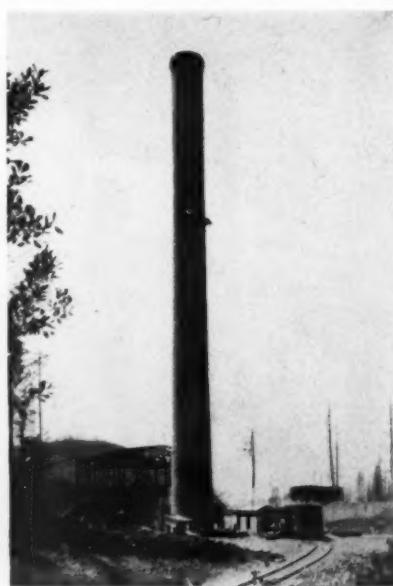


Fig. 7. The stack with the Cottrell under construction at the base

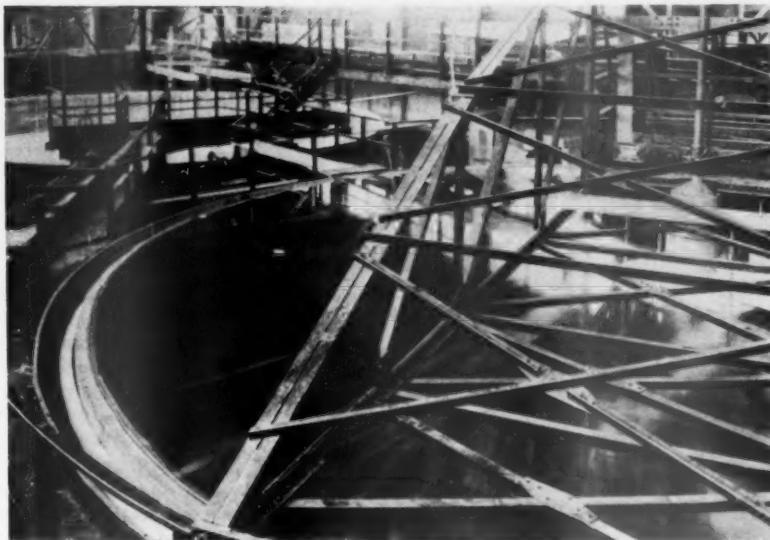


Fig. 9. A thickener and paint tank are in closed circuit with the cells

south and west sides. Overflow of the reservoir has been provided by lowering the level of the west wall, the water discharging into the spillway.

Domestic water supply is obtained from the creek, by a submerged dam, a pipe line being laid to domestic water tanks above the plant. Water for fire protection is pumped from these tanks to tanks on the hill near the smokestack, from which an 8-in. line distributes to fire hydrants.

**Power Supply**—Power is obtained from the Washington Water Power Company's switching station at 110 kv. One line at 110 kv. comes from the East Side Substation at Spokane, while a 60-kv. line comes from the Post Falls plant. An interconnected third line at 110 kv. comes from the Montana Power Company's Thompson Falls plant, and can be used in case of a shut down on the other two. The current is stepped down at the substation in three 110-kv. to 2,300-volt oil-insulated transformers. These are protected by an oxide film lightning arrester and a 110-kv. oil circuit breaker.

**Stack and Flue**—The stack is of brick, with a special acid-proof lining. It is 250 ft. high by 14 ft. inside diameter at the top. Being placed on a hilltop some 232 ft. above the plant it will carry the gases high into the upper air strata. The foundation is reinforced concrete. The flue is all steel,  $\frac{3}{4}$ -in. plate, of the balloon type, 10 ft. wide by 1,152 ft. long. Cleanout doors are placed every 4  $\frac{1}{2}$  ft.

**Dust Recovery**—Considerable dust is carried in the roaster gases, due to the fineness of the feed. This is recovered in the Cottrell plant, which is situated at the base of the stack. It is the plate and wire type of precipitator, consisting of two units of five sections each. Four

sections of each unit are installed for treating, electrodes being omitted from the third section. This arrangement has been found to give highly efficient treatment of the gases. Collecting electrodes are of corrugated iron, and the discharge electrodes of black iron wire, spaced at 4-in. centers. The electrical equipment consists of two a. c., 15-kv. a., single-phase, 60-cycle transformers with a 400-volt primary and a 60,000-volt secondary, with reduced capacity taps, and two mechanical disk rectifiers driven by synchronous motors at 1,800 r. p. m.

With the foregoing summary of the plant's construction, a few words on the equipment and operation will be added. Lack of time and space forbids mention of the various details, but the writer will try to give a general idea of the plant installation and its working.

#### PERSONNEL

Wallace G. Woolf, metallurgical engineer, who for years has been supervising the experimental work at the North Mill pilot plant, has assumed the superintendence of the plant. The late Fred Beasley was appointed assistant superintendent, and E. R. Crutcher is metallurgist. A. B. Wadsley is chief chemist and head of the assay laboratory, while A. V. Dunkle is chief electrician.

The foremen of the plant have been selected from the men who have assisted in the experimental work and building. The wisdom of this course has been demonstrated by the remarkably successful beginnings of each successive operation. At the time of the writing of this article the last cell unit is about to be started, and there are yet to be any serious mishaps due to either faulty construction or operation.

#### PLANT EQUIPMENT AND OPERATION

Five 270-ton capacity reinforced concrete bins receive the concentrates from the cars. At the normal rate of feed this is a 10-day supply for the roasters. A system of belt conveyors with a weightometer and bucket elevator carry the feed to roaster feed hoppers, which feed five 25-ft. 8-hearth Wedge roasters, each having a nominal capacity of 40 tons per 24 hours. Rabble arms, of which there are two to each hearth, are air cooled, the air thus heated being discharged into the atmosphere or onto the hearth for roasting. This last feature, which seems particularly worthy of note here, is accomplished by fitting a 3-in. pipe, with a three-way valve to the air discharge pipe of the rabble arms, and through the central shaft so that it extends out over the hearth. At 45 degrees from the perpendicular  $\frac{1}{8}$ -in. holes are drilled in the pipe. Preheated air is thus admitted to the roast in controlled quantities and in such a way that it breaks up the blanket of  $\text{SO}_2$  lying over the bed, giving more contact of oxygen with the roasting particles, and a more efficient roast, without at the same time cooling the gases in the furnace. Where oxidation is particularly rapid, air can be diminished, if necessary, to hold the temperature to the desired point. A multiple electric recording pyrometer, with a thermocouple on each hearth, serves to check the temperatures at all times. Furnaces are auxiliary oil fired on the seventh hearth.

A 14-in. Jacoby conveyor is used to convey the calcines from the roasters. This conveyor is the rotary type fixed internal spiral, which, due to its rotary motion, has large radiation losses. It thus becomes a cooler as well as a dust-proof conveyor. Screening of the calcines is at 20-mesh on a Leahy vibrating screen, the oversize being crushed and reroasted, the undersize passing to two Dings-Wetherill magnetic separators by means of screw conveyors. The magnetic zinc ferrite and the non-magnetic zinc oxide products go into five reinforced concrete bins of 100 tons capacity each. All calcine handling conveyors and feeders are enclosed to prevent dusting. A dust collector has been installed and pipes connected to all dusty points.

**The Leach**—Leaching is accomplished in three 20-ft. by 13-ft. woodstave, lead-lined agitator tanks. The agitator consists of a central vertical shaft supporting an arm radially, from which is suspended eight lead-covered fingers. Each agitator shaft is driven by an individual motor, power being transmitted through a James speed reducer and a bevel gear. Solutions are heated by lead steam coils.

The zinc ferrite is first added to a 28 to 30 percent sulphuric acid solution, and is dissolved. When the acidity approaches

15 percent the more soluble oxide and sulphate is added, and the leach brought to neutrality. Manganese dioxide is added to oxidize the iron so that it will precipitate out as a ferric hydrate as the leach is neutralized.

Six Burt filters take the leached pulp from a surge tank. These filters are the rotary internal pressure type, 4 ft. 6 in. inside diameter, by 40 ft. long. They are especially adapted to filtration of a gelatinous pulp, and wash the zinc sulphate from the cake with a minimum of wash water. The filtrate discharges into a sump, from which it is pumped to solution storage tanks, ready for purification. The residue is thickened, filtered, and dried, and sent to the smelter for the recovery of the lead and silver.

**Purification**—The filtrate containing the impurities cobalt, copper and cadmium are drawn from the storage tanks to purification tanks. These are 22 ft. in diameter and 15 ft. in height, wood stave, and lead lined, with lead pipe steam coils for heating. Agitation is mechanical as in the leach tanks. When the solution temperature is right zinc dust is added and agitation continued until the impurities are brought down. Purified solution is then filtered in 36 by 36 in. Shriver pressure filter presses, and discharged into two 30-ft. diameter check tanks. If sufficiently low in impurities, it is ready for the cells. Careful check is made at all times to insure pure solutions. Operators are given simple tests with which to determine the progress of the purifying, and the final sample is sent to the assay office for check analysis, before release to the cells.

**Electrolytic Department**—A lead-lined launder carries the neutral solution from the neutral storage tanks to the cell circuit, while a pipe line carries back to the electrolyte storage tanks a similar amount of spent electrolyte. For this purpose a steel bridge was built from the tank floor of the main building to the cooling room across the tracks. This bridge is completely enclosed, with gunite walls.

Electrolyte circulates continuously from the cells to a 42-ft. lead-lined balance tank. From here it is pumped by Antisell type lead-lined pumps to five cooling cells in which are immersed lead cooling coils connected in parallel to the water supply line from the reservoir. Circulating about these coils, electrolyte is cooled to the working temperature of the electrolytic cells, and passed on to the cell feed launders. When the acid regenerated in the cells approaches 28 percent and the zinc content has decreased to about 10 percent, neutral solution containing about 220 grams of zinc per liter is drawn from the neutral storage tanks, and added to the balance tank revitalizing the spent electrolyte; and at the same time, as mentioned above, a



Fig. 10. The first car of slab zinc being loaded for shipment

similar amount of spent electrolyte is pumped back to electrolyte storage tanks and used in the leach.

Cells are fed individually through hard rubber pipes from the overhead feed launders, and discharged individually through a hard rubber overflow pipe to sumps below. In case of trouble the entire load can be dropped in a few minutes. Each cell contains 20 lead alloy anodes and 10 sheet aluminum cathodes, or two anodes per cathode. The cathode header bar is copper plated at the contact and slips into a copper clip on the bus bar, making a good connection. The anode is cast in the shape of a grid to permit better circulation of the electrolyte between anode and cathode resulting in higher current efficiency.

The cells in each unit are electrically connected in series to the 8,000-ampere, 500-volt motor generator set. The cathodes of each cell are connected in parallel. Thus there is a flow of 800 amperes per cathode, or about 100 amperes current density per square foot of cathode surface.

The cathode melting furnace is a small reverberatory, 15 ft. wide by 28 ft. long, the hearth and arch being built on a 50-ft. radius curve, with a slope toward the ladling wells. Charging is through a swinging door at the top. At the flue end of the furnace, built into the hearth, are two wells, with inlet from the bath at the bottom. Zinc is ladled from the wells in two steel plate ladles suspended from a trolley. The mold racks are under, and to one side of the trolley beams. Pouring is by hand, each slab weighing approximately 60 lbs.

**Zinc Dust Plant**—Zinc dust for purification is blown by subjecting a slender

stream of molten zinc to a high pressure air jet. Molten zinc is ladled from the melting furnace into a graphite crucible zinc dust furnace. Expanding air as well as the high pressure from the V-shaped jet pulverized the zinc in the stream to between 50 and 60 percent through 200 mesh.

#### CONCLUSION

Though the plant has not as yet come into full production, its different departments now operating have shown results which seem to assure the ultimate success of the enterprise. Mechanical adjustments have been and are being made. A recent assay of the cathode zinc now being obtained showed a purity of 99.994 percent, which is extreme even for electrolytic zinc.

The author wishes to acknowledge his debt to all whose suggestions and corrections have contributed to the writing of this article. To Wallace G. Woolf especially are thanks due for his constructive criticism, and assistance.

#### PHYSICAL CHEMISTRY OF STEEL MAKING

The results of certain phases of a general study of the physical chemistry of steel making, dealing specifically with the elimination of undesirable inclusions which are often responsible for the failure of steel, are embodied in two bulletins just published by the Carnegie Institute of Technology, in cooperation with the United States Bureau of Mines, and the Mining and Metallurgical Advisory Board. Bulletin 36, by C. H. Herty, Jr., physical chemist of the Bureau of Mines, and G. R. Fitterer, research fellow, Carnegie Institute of Technology and junior metallurgist of the Bureau of Mines, deals with "Deoxidation with Silicon and the Formation of Ferrous-Silicate Inclusions in Steel." Bulletin 37, by Messrs. Herty and Fitterer and J. F. Eckel, research fellow, Carnegie Institute of Technology, is a "Study of the Dickenson Method for the Determination of Nonmetallic Inclusions in Steel."

In May, 1926, the Bureau of Mines in cooperation with the Metallurgical Advisory Board, and the Carnegie Institute of Technology, began a study of the physical chemistry of steel making. Many of the phenomena taking place in iron and steel manufacture are little understood, and it was the belief of the three cooperating parties that an intensive study of certain of these phenomena would lead to better operation of furnaces, to a better understanding of steel in ingot form, to a greater knowledge of the physical properties of steels, with particular regard to the effect of these constituents which are, at the present, more or less indeterminate.

# The OUTLOOK for MINING LEGISLATION\*

*Of Especial Importance In Legislative  
Needs Is Reorganization Of The Bureau  
Of Budget—Cooperation Of Industry In  
Behalf Of Its Official Government  
Bureaus Urged*

By HON. TASKER L. ODDIE †

I WILL discuss briefly the relation between our Government and the mining industry, and the legislation that is needed for the industry. First, I want to pay the highest compliment to the officials of the Bureau of Mines and the Geological Survey, these men who are working tirelessly and skillfully for the welfare of the mining industry and of our whole country. These men have their hands tied, as have other bureau chiefs in the Government service, by a policy which in many ways is necessary and beneficial, but which contains some serious flaws which must be and will be corrected.

I refer to the Bureau of the Budget. We know that that institution is a very necessary thing; but there is something inside of that Bureau that must be corrected, and some Members of Congress are going to strive hard to correct it.

I will not go into the details of the mining needs, because you know them. But I will give you a little history of the way legislation is put through. The various bureau chiefs submit their estimates for the expenses of the bureaus for the coming year to the department heads, who go over these suggested estimates, and the final allocations of money are arrived at for the respective bureaus. The department and bureau heads can not ask Congress for what they want, what they need, what the bureau chiefs need, if these amounts exceed what the Budget says they can have.

What is the result? In this vast Government of ours, which is expending between three and four billion dollars a year, one man, the Chief of the Bureau of the Budget, sets the limit of the appropriations for the various governmental departments. The chiefs of the bureaus are selected for their various positions because they are scientifically trained and equipped men in their particular fields. They know the needs of

their respective offices and the industries they represent, and know what they should have in order to carry on the work for which they are responsible.

The trouble is that in the Budget Bureau the men who determine how much these various bureaus can or can not have are not technically trained men; their standard is only the standard of bookkeeping—how much can be cut off appropriations. One of my colleagues in the Senate spoke to me about this matter yesterday in regard to some appropriations for reclamation projects. He went to the clerk in the Bureau of the Budget who handles those matters, and he got an admission from him that he never had been on a reclamation project, and knew nothing about the subject, and yet he cut the appropriations all along the line.

This rule of thumb method of cutting appropriations in this manner is not true economy. It costs the American people, our industries and national welfare millions and millions of dollars each year.

In order to have an intelligent handling of this serious and tremendous problem, the Bureau of the Budget should be reorganized; and it is our duty to see that it is reorganized, and that mining engineers and geologists, and other technically trained men are selected for the Budget Bureau to pass on these technical problems. I strongly recommend that other departments of our Government do likewise.

And I repeat that the present system is costing our Government and the Nation's industries hundreds of millions of dollars. I propose, before this session is over, to take up some questions relating to forestry conservation and the welfare of our national watersheds and industries to show that this present policy is costing our Government, in the destruction of forests and in the destruction of our watersheds, hundreds of millions of dollars, where the expenditure of only a comparatively few thousand dollars would save us these many mil-



lions. It is too serious a matter to be taken lightly.

Take another matter, as an illustration: the Mississippi flood problem, which cost our people hundreds of millions of dollars and for which Congress was busy in the last session appropriating many millions of dollars to prevent future floods. Do you realize that several years ago Congress passed an appropriation, in the Temple bill to authorize the Geological Survey to complete its topographical survey in the states affected. The Budget Bureau has only allowed a portion of the authorized appropriation to be made so the work has been greatly hampered. If that work had been promptly carried out as was contemplated by Congress, and as the Geological Survey recommended, this Mississippi flood problem would have been a simpler, smaller and easier problem altogether today. As it is, only about 8 percent of this work has been completed in the Mississippi area. The Yazoo delta is about all, and in this completed area, I am informed that there was practically no damage. If this topographic work had been completed, the taxpayers would have been saved many millions of dollars and enormous losses would have been averted. That is false economy. I propose to try to get my associates in the Senate, as many of them as I can, to work with me with a view to having these conditions corrected. We will try to have the Bureau of the Budget reorganized, and have men put at the head of the Budget units who are technically trained men, sufficiently trained to pass on these technical matters that come before them, so that when governmental matters are to be decided they will be decided by men who understand them.

This is no reflection on General Lord, the head of the (Continued on page 80)

\* Presented to Thirty-First Annual Convention of The American Mining Congress.

† United States Senator for Nevada. Chairman, Senate Committee on Mines and Mining.

# LEGISLATIVE REVIEW



## *COLORADO RIVER Development Bill Passed By Senate—Government Or Private Construction And Operation Of Power Plant Authorized —Congress Busy On Work Of Short Session—Hearings By Senate Interstate Commerce Committee On Proposed Legislation To Stabilize The Bituminous Industry—Tariff Revision Hearings Begin January 7 In Preparation For Revenue Changes In Extra Session—Mexican Immigration Restriction Recommended*

**C**ONGRESS has gotten away to a good start on the legislative program of the present session which will end March 4, next. The Senate on December 14 passed the Colorado River development bill which has been pending in Congress for several years and which has been the subject of much debate. Under this measure the Government may build and operate the huge electric power plant to be used in connection with the flood-control and irrigation development features of the measure, or it may authorize its construction and operation by private interests. The power to be developed at the project is expected to stimulate industries in the states through which the river flows, and Senator Oddie (Republican, Nevada) predicts the construction of a copper refinery at Las Vegas, Nev.

Hearings were held and will be resumed early in January by the Senate Committee on Interstate Commerce on proposed legislation affecting the bituminous industry as a result of the investigation conducted at the last session into strike conditions in western Pennsylvania, Ohio, and West Virginia. The committee is considering the bill introduced by Senator Watson (Republican, Indiana), its chairman, at the last session at the request of the miners' union, providing for government regulation of the industry through a coal commission. This legislation would authorize consolidations, mergers and cooperative marketing agreements in the industry and would require the licensing of corporations producing and shipping coal in interstate commerce. Differences immediately developed at the opening of the hearing when Secretary of Labor Davis opposed government regulation or operation of the industry, while John L. Lewis, the head of the union, favored such regulation and control. After the committee hears other interested parties, it will endeavor to draw up a bill and refer it to the Department of Justice for an opinion as to its legality, as the pending proposals involve amendment of the

anti-trust laws, which are administered by that department.

Preparations are being made by Congress to revise the present tariff law which has been in effect since September, 1922. The House Committee on Ways and Means, which must originate revenue legislation, will begin hearings January 7 on proposed revision of the act. It is contemplated to bring in a tariff revision bill for action by Congress at an extra session to be held sometime after March 4 next. Opinion as to the date of the extra session is divided. Some legislators favor an extra session beginning April 10, while others oppose an extra session before fall and are suggesting that the extra session be called in October to avoid working in the heat of summer.

Legislation to apply the 2 percent quota immigration law restriction to Mexico has been recommended by the Senate Committee on Immigration.

While a large number of new bills have been introduced at the present session which opened December 3, none of an outstanding character affecting the mining industry have been presented. The House has been busy passing the appropriation bills for support of the Government during the new fiscal year beginning July 1 next. It voted to abolish the mint at Carson City, Nev., and the assay office at Salt Lake City, Utah, but the Senate promptly restored these items and the offices will not be disturbed. Government officials have been trying to abolish some of these smaller offices and concentrate the work at the larger mints, but western Congressmen have been able to retain them for service to the western mineral industries.

The following is a summary of new bills and action on old bills taken since December 3:

H. R. 14453, Mr. Casey (Dem., Pa.)—

This bill is similar to that previously introduced by Senator Watson and provides for a coal commission to regulate, under license, corporations producing and shipping coal in interstate commerce. It authorizes consolidations, mergers, and cooperative marketing agreements in the bituminous industry. Interstate Commerce.

H. R. 393. This bill provides for the taking by the Census Bureau in 1929 of a census of mines, population, distribution, agriculture, irrigation, and drainage. Reported by Senate Committee on Commerce.

### TARIFF BILLS

H. R. 14480 and 14804, Mr. Williamson (Rep., S. Dak.)—These bills propose a duty of \$3 per ton on imported crude feldspar. Ways and Means.

H. R. 14462, Mr. Howard (Dem., Okla.)—This bill proposes a tariff duty of \$1 per barrel on crude mineral oils. Ways and Means.

H. R. 15217, Mr. Leavitt (Rep., Mont.)—This bill amends section 3 of the Act of July 17, 1914, providing for agricultural entry on lands withdrawn for phosphate, nitrate, potash, oil, gas, or asphaltic minerals, to read as follows:

"That any person who has in good faith located, selected, entered, or purchased, or any person who shall hereafter locate, select, enter, or purchase, under the non-mineral land laws of the United States, any lands which are subsequently withdrawn, classified, or reported as being valuable for phosphate, nitrate, potash, oil, gas, or asphaltic minerals, may, upon application therefor, and making satisfactory proof of compliance with the laws under which such lands are claimed, received a patent therefor, which patent shall contain a reservation to the United States of all deposits on account of which the lands were withdrawn, classified, or reported as being valuable, together with the right to prospect for, mine, and remove the same: Provided, however, That the provisions of this section shall not apply to lands so located, selected, entered, or

purchased prior to July 17, 1914." Public Lands.

S. 4691, Mr. Smoot (Rep., Utah)—This bill extends for one year the provisions of section 18a of the leasing law to lands in Utah withdrawn by Executive order October 4, 1909. Public Lands.

S. 1512. This bill provides for contests of oil and gas permits. Passed by Senate and referred to House Public Lands Committee.

H. R. 10885. Enacted into law. This law amends the leasing law by reducing the royalties to be paid the Government under sodium prospecting permits and leases. The royalty is fixed at 2 percent of the gross value of the output of sodium compounds, instead of one-eighth of the amount or value of the production. The advance rental is placed at 25 cents per acre instead of 50 cents for the first year. For the second to fifth years of the lease the rental will be 50 cents and for the balance of the lease \$1 per acre per year instead of \$1 per acre per year for the second and subsequent years. Twenty-year leases with 10-year renewals are provided instead of indeterminate leases subject to readjustment at the end of each 20 years. The new law eliminates agreements relative to mining methods, waste, period of preliminary development and minimum production, and provides that the Interior Department shall issue regulations governing the leases. The new law will also apply to lands in San Bernardino County, Calif., which were exempted by the former act. The law reads as follows:

"That the Secretary of the Interior is hereby authorized, under such rules and regulations as he may prescribe, to grant to any qualified applicant a prospecting permit which shall give the exclusive right to prospect for chlorides, sulphates, carbonates, borates, silicates, or nitrates of sodium in lands belonging to the United States for a period of not exceeding two years: Provided, That the area to be included in such a permit shall not exceed two thousand five hundred and sixty acres of land in reasonably compact form.

"That upon showing to the satisfaction of the Secretary of the Interior that valuable deposits of one of the substances enumerated have been discovered by the permittee within the area covered by his permit and that such land is chiefly valuable therefor, the permittee shall be entitled to a lease for any or all of the land embraced in the prospecting permit at a royalty of not less than 2 per centum of the quantity or gross value of the output of sodium compounds and other related products at the point of shipment to market; the lands in such lease to be taken in compact form by legal subdivisions of the public land surveys or, if the land be not surveyed, by survey

#### IMPORTANT BILLS REVIEWED IN THIS ISSUE

##### Mining

H. R. 14453—Casey (D., Pa.). **Government Regulation. Interstate Commerce.**  
 H. R. 393—Mine Census.—Reported by Senate Committee.  
 H. R. 14480—Williamson (R., S. Dak.). **Feldspar Tariff. Ways and Means.**  
 H. R. 14462—Howard (D., Okla.). **Mineral Oil Tariff. Ways and Means.**  
 S. 4691—Smoot (R., Utah). **Amend Leasing Law. Public Lands.**  
 H. R. 10885—Sodium Leases. **Enacted Into Law.**  
 S. 3776—Land Title. **Passed by Senate and House.**  
 H. R. 14933—Hale (R., N. H.). **Naval Oil Reserves. Naval Affairs.**

##### Immigration

S. 1437—Harris (D., Ga.). **Quota Law Against Mexico. Reported by Committee.**  
 S. 4842—Black (D., Ala.). **Ten-year suspension. Immigration Committee.**

##### Government

H. J. Res. 337—Byrns (D., Tenn.). **Reorganization Plan. Rules.**  
 H. R. 14672—Jones (D., Texas). **Price and Industry Control in War. Military Affairs.**

##### Power

H. R. 5773—Swing (R., Calif.). **Colorado River Project. Passed by Senate and House.**  
 H. R. 15213—Leavitt (R., Mont.). **Indian Projects. Indian Affairs.**

##### Labor

H. J. Res. 335—Dallinger (R., Mass.). **Hours and Conditions. Judiciary.**  
 H. R. 14454—Casey (D., Pa.). **National Employment System. Judiciary.**

executed at the cost of the permittee in accordance with regulations prescribed by the Secretary of the Interior. Lands known to contain valuable deposits of one of the substances enumerated and not covered by permits or leases shall be subject to lease by the Secretary of the Interior through advertisement, competitive bidding, or such other methods as he may by general regulations adopt and in such areas as he shall fix, not exceeding two thousand five hundred and sixty acres. All leases shall be conditioned upon the payment by the lessee of such royalty as may be fixed in the lease, not less than 2 per centum of the quantity or gross value of the output of sodium compounds and other related products at the point of shipment to market, and the payment in advance of a rental of 25 cents per acre for the first calendar year or fraction thereof, 50 cents per acre for the second, third, fourth, and fifth calendar years, respectively; and \$1 per acre per annum thereafter during the continuance of the lease, such rental for any one year to be credited against royalties accruing for that year. Leases shall be for a period of twenty years, with preferential right in the lessee to renew for successive periods of ten years upon such reasonable terms and conditions as may be prescribed by the Secretary of the Interior unless otherwise provided by law at the expiration of such period: Provided, That nothing in this Act shall prohibit the mining and sale of sodium compounds under potassium leases issued pursuant to the Acts of October 2, 1917, and February 7, 1927, nor the mining and sale of potassium compounds as a by-product from sodium leases taken under this section: Provided further, That on application by

any lessee the Secretary of the Interior is authorized to modify the rental and royalty provisions stipulated in any existing sodium lease to conform to the provisions of this section."

S. J. Res. 167, Mr. Walsh (Dem., Mont.)—This resolution permits Government counsel in the naval oil reserve lease prosecutions to conduct private practice before Government departments. O. J. Roberts, of Philadelphia, one of the Government attorneys, resigned because the present law forbids his private practice. He will resume the cases if the legislation is passed. Passed by Senate and House.

S. 4674, Mr. Nye (Rep., N. Dak.), and H. R. 15475, Mr. Smith (Rep., Idaho)—These bills establish the Grand Teton National Park in Wyoming and revise the boundary of the Yellowstone National Park in Montana, Wyoming, and Idaho. The legislation will not affect claims or entries under the mineral or other land laws. Public Lands.

S. 3776. This bill grants title to 160-acre tracts of public land which have been held for more than 20 years under claim or color of title, on payment of not less than \$1.25 per acre. Passed by the Senate and House.

H. R. 14933, Mr. Hale (Rep., N. H.)—This bill authorizes the Navy Department to protect the Government naval oil reserves by exchanges of land or royalty oil with private landowners adjoining the reserves. The bill authorizes contracts by the Navy with owners and lessees of land within or adjoining the reserves for compensation for estimated drainage in place of drilling or operating offset wells, and to exchange Government land in Reserve No. 1 or the right to royalty production from any

of the reserves for privately owned land or leases in Reserve No. 1 in order to consolidate and protect Government oil land. These transactions must have the approval of the President and be reported to Congress. Naval Affairs.

H. R. 8830. This bill authorizes the payment of \$16,339 to Robert Toquothy, an Indian, representing royalties from an oil and gas well held by him in the bed of the Red River, in Oklahoma. Reported by House Indian Committee.

#### TAX REFUNDS

S. 4993. Mr. McKellar (Dem., Tenn.). This bill proposes that the Board of Tax Appeals shall pass on tax refunds of more than \$500 by the Internal Revenue Bureau. These refunds are to be certified to the board on the first of January, April, July, and October. Judiciary.

S. 1437. This bill proposes to apply the 2 percent immigration quota restriction to Mexico effective July 1, 1929. Reported by the Senate Immigration Committee.

S. 4842. Mr. Black (Dem., Ala.). This bill proposes to suspend immigration into the United States for ten years beginning July 1, 1930. Immigration.

H. J. Res. 351. Mr. Hoch (Rep., Kans.). This resolution proposes a constitutional amendment to exclude aliens from the basis of population on which members of Congress are elected. Judiciary.

S. J. Res. 117. This resolution appropriates \$150,000 for surveys by the War Department of the proposed Nicaraguan canal. Reported by Interceanic Canals Committee.

H. J. Res. 355. Mr. Cole (Rep., Iowa). This bill appropriates \$50,000 for surveys for an inter-American highway. Foreign Affairs.

H. R. 14677. Mr. O'Connor (Dem., La.). This bill proposes to appropriate \$500,000 for maintaining an international trade exposition at New Orleans. Foreign Affairs.

H. R. 15076, Mr. Hadley (Rep., Wash.); H. R. 15078, Mr. Hill (Rep. Wash.); S. 4720, Mr. Dill (Dem., Wash.). These bills propose an appropriation of \$25,000 to aid the State of Washington in surveying and locating a low-level tunnel under the Cascade Mountains between Skykomish and Leavenworth, Wash. Public Lands and Military Affairs.

H. R. 13884. This bill authorizes various naval construction projects, including \$130,000 for a metal aircraft structures shop at the air station at San Diego, Calif. Passed by the House.

H. R. 14156. Mr. James (Rep., Mich.), and S. 4642, Mr. Reed (Rep., Pa.). These bills appropriate \$125,000 for construction of a cannon powder blending unit at the Picatinny Arsenal at Dover, N. J. Military Affairs. The House bill has been reported by the Military Committee.

H. J. Res. 337. Mr. Byrns (Dem., Tenn.). This resolution authorizes a committee of three Senators and three Representatives to investigate and report on reorganization of the administrative services of the Government; to check overlapping and duplication of authority; to determine redistribution of activities; to correlate them and regroup departmental services so that each executive department can cover services having close working relation with each other, and to establish efficiency and economy in the Government business. The committee is to report not later than December, 1929. Rules.

S. 4706. Mr. Walsh (Dem., Mont.). This bill makes it unlawful for any person, firm, corporation or association engaged in interstate commerce to give anything of value to teachers or members of school boards for writing or revising textbooks or other matter used in the schools or to induce the use in any school of any book or printed matter or to teach any doctrine with intent to influence opinion in favor of any Government action or public policy advocated by or beneficial to such persons or corporations. Labor.

H. R. 14672. Mr. Jones (Dem., Tex.). This bill provides that in case of war the President shall take charge of the material resources and other industrial organizations and to stabilize the prices of services and of any or all commodities essential to carrying on the war. Military Affairs.

#### COLORADO RIVER

H. R. 5773. This bill provides for flood control, irrigation, and power development on the Colorado River, at a cost of \$165,000,000. Under the project a dam will be constructed across the river at Black Canyon, this location having been recommended by a board of engineers and geologists appointed by the Interior Department. A power plant is contemplated at a cost of \$38,000,000. The bill provides an option for construction and operation of this project by the Government or by private enterprise. The Senate substituted its bill, S. 728, for the House measure, and passed it.

H. R. 15213. Mr. Leavitt (Rep., Mont.). This bill authorizes the Interior Department to develop and lease power on Indian irrigation projects. The leases would be for 10 years, with preference for municipal purposes. Indian Affairs.

S. 4710, Mr. Phipps (Rep., Colo.), and H. R. 14674, Mr. Taylor (Dem., Colo.). These bills authorize the sale of surplus power developed under the Grand Valley reclamation project in Colorado. Irrigation.

H. J. Res. 335 and 347. Mr. Dallinger (Rep., Mass.). The first resolution proposes a constitutional amendment giving

power to Congress to establish uniform hours and conditions of labor for women and minors throughout the country and to prohibit the employment of children under such ages as Congress may determine. The second proposes a constitutional amendment giving Congress power to establish uniform hours and conditions of labor throughout the country. Judiciary.

H. R. 15385. Mr. Zihlman (Rep., Md.). This bill proposes to regulate the use of spray-painting compressed-air machines. Labor.

H. R. 14454. Mr. Casey (Dem., Pa.). This bill proposes to establish in the Department of Labor a national employment system to cooperate with the states and to regulate the expenditure of money in order to stabilize employment. It authorizes appropriations of \$4,000,000 for each year up to June 30, 1932, 75 percent of which shall be allotted to the states for maintaining public employment offices. Judiciary.

H. R. 14156. Mr. Woodruff (Rep., Mich.). This bill increases from \$300,000 to \$400,000 the cost of constructing an experimental metal-clad airship authorized in 1926 for the Navy. Naval Affairs.

H. R. 14922. This bill increases from \$5,300,000 to \$6,650,000 the cost of construction and machinery for each of two fleet submarines for the Navy. Passed by the House.

H. R. 8529. This bill authorizes the Court of Claims to consider a refund of \$60,283 alleged to have been erroneously collected as tonnage taxes from the Standard Oil Company of New Jersey in 1920 and 1921 on three vessels operated by it under charter. Enacted into law.

H. R. 15200. Mr. Zihlman (Rep., Md.). This bill proposes to pay \$95,066 to the Intercean Oil Company for expenses and damages in 1918 in removing tanks from Carteret, N. J., to Baltimore for Government storage purposes. War Claims.

S. 4690. Mr. Smoot (Rep., Utah.). This bill proposes to pay \$16,600 to the Great Western Coal Mines Company as a refund of purchase money paid to R. L. Bird in connection with a coal land entry, title having been given to the United States by the company as assignee of Bird. Claims.

H. R. 15032 and H. R. 15033. Mr. Guyer (Rep., Kans.). These bills propose to pay \$6,302 to the Smith Leavitt Coal Company in connection with Army coal contracts. Claims.

S. 4808. Mr. Howell (Rep., Nebr.). This bill proposes to pay \$7,192 to the Western Electric Company under a War Department contract. Claims.

H. R. 15380. Mr. Edwards (Dem., Ga.). This bill proposes to appropriate \$100,000 to establish a reforesting station in Georgia. Agriculture.

# HEARINGS on COAL LEGISLATION

## Senate Interstate Commerce Committee Takes Up Proposed Regulatory Measure—Secretary Of Labor Davis Recommends Consolidation Of Bituminous Op- erating Companies Into 100 Or 200 Units—John L. Lewis Advocates Government Regulation

THE battle over proposed regulation of the bituminous industry by a governmental commission has been resumed in Congress. With adjournment of the session automatically occurring March 4 there is little prospect, however, of action at the present sitting of Congress. On December 14 the Senate Committee on Interstate Commerce began hearings on proposed legislation to stabilize the industry in the light of its investigation at the last session into strike conditions in western Pennsylvania, Ohio and West Virginia. At this hearing, amendment of the anti-trust law to permit voluntary consolidation of the bituminous coal mines of the country into 100 to 200 large companies was recommended by Secretary of Labor Davis. He thought this action would stabilize the industry without the necessity of Government operation or regulation of mines.

On the other hand, complete Government regulation of the bituminous industry, for the purpose of establishing an industrial code of practice governing production and distribution was declared to be necessary to stabilize the industry by John L. Lewis, president of the miners union.

The committee will hear early in January proponents and opponents of S. 4490, introduced by its chairman, Senator Watson (Rep., Ind.), at the request of the union, which provides for a coal commission to license and regulate consolidated companies, after which any legislation the committee may decide upon will be referred for opinion to the Attorney General.

Both Secretary Davis and Mr. Lewis analyzed present unsatisfactory conditions in the industry and said something should be done to prevent continuance of over-production and unremunerative prices for coal.

Secretary Davis stated that loss of operation of mines by strikes had been only 14 percent during the last 23 years while that from no markets, car shortages and mine disabilities was 86 percent. He stated that mines were equipped to produce 300,000,000 more tons than the country requires. Reference was made to the large productive capacity of Illinois mines. He quoted frequently from addresses he had made before conventions of the American Mining Congress on the

situation in the industry. He also quoted S. A. Taylor, mining engineer as to loss of coal markets caused by substitute fuels and increased efficiency in the use of fuel, and suggested that the committee secure evidence from Mr. Taylor.

Secretary Davis referred to the increased use of machinery in the coal, metal mining and steel industries. He said that while the spread of machinery into coal production will displace from 50,000 to 150,000 miners, public benefit will result from mechanization through conservation and lower prices. By-products will take up the men displaced in the mines by machinery.

Secretary Davis said that consolidated mines would compete with one another and could operate as successfully as mines operated by steel and other industries. He favored practical leadership and organization in the industry to carry out the reorganization plan. He deplored the existing waste in mining and marketing methods. Larger companies should pay the owners of surplus mines to go out of business. He referred to the high taxes on coal lands which he said were based on the value of the coal when mined, which were unfair and forced their operation in many cases in order to meet the taxes.

### CODE OF ETHICS

Secretary Davis suggested that operators and miners adopt a code of ethics and fair practices. "Radical changes are necessary to reorganize the industry," said Secretary Davis. "It will stabilize employment, output and markets and assure fair returns to the operator. The cooperation of railroads, manufacturing industries and public utilities is essential."

All of the Senators seemed to agree with the analysis of the situation and asked questions to develop remedies. Senator Sackett, Republican, Kentucky, said the Government could not interfere with coal production as it was private business. He wanted to know if the Government could control the mining of natural resources to prevent waste and referred to the Bureau of Mines as a pos-

sible supervisor of mining operations. He thought such action would reduce waste in mining and would control the number of mines in operation. Secretary Davis thought this situation would be taken care of by the larger producing units. He referred to the use by a West Virginia company of a conveyor system which had removed all the coal from the mine and had paid for itself. Senator Watson said mining is not interstate commerce, and Senator Goff, Republican, West Virginia, said the limitation on opening of mines and production would take property without due process of law. "Nobody is thinking of doing that," said Secretary Davis. "If you interfere with a man's property, that is equivalent to taking it," said Senator Goff. Secretary Davis said these technical points could be overcome. He referred to unsatisfactory conditions in the Bicknell, Ind., field as a reason for settling present unsatisfactory conditions. Senator Goff said he is interested in solving the problem from a practical and legal standpoint. Secretary Davis said Congress could amend the present law, and if it involved constitutional questions it could be passed on by the Supreme Court. To meet the situation Congress could also amend the Constitution.

Senator Goff asked if the proposal of Senator Sackett would involve Government control of the mining industry, and Secretary Davis replied that he did not favor such action. Senator Goff thought the proposal would involve the Government control of mines, but Secretary Davis thought not. When Senator Watson suggested that if the mines did not consolidate voluntarily compulsory action might be necessary, Secretary Davis said that situation could be handled when it developed. He did not think there would be any difficulty over voluntary mergers, as coal operators had told him that the only thing standing in the way is the anti-trust law. Secretary Davis said a consolidation movement is developing as the industry is beginning to understand that that is the only way out. Senator Watson said the industry needs a boss.

Secretary Davis stated that coal and

copper mine operators had advised him of their plans to install machinery and that advances in machinery are also being made in the iron and steel industry.

#### MINING NOT INTERSTATE COMMERCE

Senator Hawes, Democrat, Missouri, said coal mining is not interstate commerce and that unless the Constitution is changed the Government can not take from the States their jurisdiction over mining. He thought permissive consolidations in mining would relieve the situation. "The regulation of mines is a state function," said Mr. Hawes. Senators Sackett and Wheeler, Democrat, Montana, and Secretary Davis said the natural resources in land belong to all the people, but Senator Hawes insisted they belong to the States. Secretary Davis stated that the movement to bring electric power plants to the mines would make it more difficult to control the situation.

Mr. Lewis declared that the sales policy of the industry is uneconomic and that the industry can not itself establish sane business relations. He declared that public utilities are buying coal below production cost, but that their rates are based on coal prices 30 to 50 percent higher than prevailing coal prices. Railroads are also profiting at the expense of the coal industry through purchases at and below production cost. Mr. Lewis said that between 100 and 150 million tons of screenings are sold at from 30 to 50 percent less than cost of production. Mr. Lewis deplored the present destructive competition in the coal industry because it reduces wages and sells labor and capital assets without increasing the consumption of coal. He declared that the public would suffer no increased burden if coal prices were doubled. "Every agency that has investigated coal has condemned the industry's incompetence," said Mr. Lewis. He declared that the industry is not justified in its fear of Government regulation. As to the claim that Government control would invade property rights, Mr. Lewis said:

"The right of private property is safeguarded because the right to own is the right to manage, but when management is incompetent it has betrayed the reason for its existence." Mr. Lewis said that financial interests have refused to finance consolidations and improvements, because of incompetence of coal management. Engineering has also found the industry guilty of technical incompetence. He also charged that the industry is wasteful.

#### COAL A PUBLIC UTILITY

Mr. Lewis argued that bituminous coal is a public utility. "Coal is already regu-

lated in one sense, regulated for waste, anarchy and chaos by the creation of an unbalanced relationship between the producing industry under economic laissez-faire and the consuming industry regulated by Government and buttressed by governmental safeguards and implied public support and authority. To continue such relationship is to put the lion and the lamb in the same cage." Mr. Lewis said that the Government had created a public utility industry and the States had created a public utility industry, both of which buy 35 percent of bituminous. In most price situations the marginal 10 percent or less determines the price level. He declared that the organized and regulated buyers dictate the price of coal for all consumers.

Mr. Lewis said union miners had recently accepted wage reductions of from 17 to 33 percent. He quoted from F. W. Shibley, of the Bankers Trust Company of New York, at the recent convention of the National Coal Association as to the need of reorganizing the industry. He also quoted Mr. Taylor on overproduction. An address of Secretary Gandy, of the Association, at the 1925 convention of the American Mining Congress regarding sales below cost was also referred to. Advice of G. J. Anderson, of the Consolidation Coal Company, to restrict production was cited.

Mr. Lewis said the future holds no promise of increased bituminous consumption. "Coal operators have not learned the value of their product," he said. John Morrow, president of the Pittsburgh Coal Company, was quoted as saying that industrial consumers pay too little for coal. Without Government regulation under Federal license, Mr. Lewis said, the industry would continue "profitless operation."

Improvement in the oil industry through cooperation with Federal and state agencies was cited as an example for the coal industry by Mr. Lewis, who said the oil industry is headed toward Government control.

Mr. Lewis said that by resorting to Federal injunctions coal operators have established the coal business as a public utility engaged in interstate commerce. He declared that Mr. Anderson, of the Consolidation Company, had, in 1922, made a report in which "he regarded coal as a public utility." Mr. Lewis said there is a fertile field for the coal chemist and technician to develop hundreds of by-products from coal.

"The public welfare demands Government regulation of the bituminous industry," said Mr. Lewis.

#### OUTLOOK FOR MINING LEGISLATION

(From page 75) Bureau of the Budget. He is an able and conscientious man. But he can not, and no man who ever lived could carry on this enormous work that he is carrying on, without technical assistance, because he is not a technically trained man.

I am convinced that if we can have adequate appropriations for the Geological Survey, and the Bureau of Mines passed on by mining engineers, geologists and economists, we will have better results in the future.

I intend to go further into this matter. I found out two years ago, in our hearings on the Naval bill, before the Committee on Naval Affairs, that the man who handles all the appropriations for the Navy, who says what the Navy can have and can not have, is an ex-Quarter-master Sergeant in the Army. I cite this as an illustration to sustain my position.

We are going to start in in Congress to have the Bureau of the Budget handled as any first-class business organization would handle matters of such far reaching importance. Agriculture, as you know, gets many times more from the Government than does mining; for scientific, technical, economic and research work; because agriculture is better organized. In Congress there is an aggregation of men who are especially interested in agriculture, who are intelligent, able and forceful, and who work together to a very large extent. The result is a tremendous increase in the appropriations for economic and research work in agriculture—many times more than for the same work in another equally important basic industry, mines and mining.

There are very few of us in Congress who are actively interested in mining, but this few of us have loud voices, and we propose to stand up and fight harder in the future. We want a united fighting mining industry back of us to get results.

#### BIG LAKE CARGO COAL TONNAGE

J. L. Good, secretary of the Ohio Coal Bureau, has announced that lake cargo coal tonnage in 1928 was the largest in history. During the season ended December 2, 1928, coal shipments amounted to 33,132,088 tons, compared with 32,716,796 tons in 1927. The tonnage in 1926 was 29,971,157 and in 1925 reached 26,128,173. Mr. Good based his statement on the report of the ore and coal exchange.

A decrease of 2,093,201 tons in receipts of all coal, compared with 1927, is shown at the Duluth-Superior docks during the 1928 navigation season, which closed December 12, according to official figures given out by Maj. P. C. Bullard, district United States engineer.



## NEWS OF THE MINING FIELD

### Manganese and Tungsten Tariff Investigations

The Tariff Commission is preparing a report on its investigation of the manganese tariff. Data has been obtained on cost of production and distribution of manganese ores and products, world sources, technology, marketing, international trade and conservation. The report will cover all phases of the industry. The commission says domestic deposits of high grade ore are small and scattered as compared with those in Russia, British India, West Africa and Brazil. "The small and irregular deposits in the United States do not lend themselves to cheap and accurate prospecting methods and are seldom opened up far enough in advance of actual mining to permit a reliable estimate of reserves," says the commission. "Less than 50,000 tons of metallic manganese has in recent years been produced from domestic ores, the remainder being imported." The commission says it has endeavored to estimate the actual and potential manganese ore reserves of the country, but the resources available for any one investigation have been inadequate to the task. It is said that cheap production by new processes for the beneficiation of low grade ores would increase the ore reserves. Cost of production of manganese by several foreign enterprises and from most of the producing mines in this country has been secured by the commission.

### TUNGSTEN

Under a Senate resolution, the commission has been investigating costs of production of tungsten in the United States and China with a view of increasing the duty and is analyzing data gathered by its experts. It points out that any changes in the basic rate on tungsten would require adjustments in the compensatory rates on tungsten in tungsten metal, alloys and in steel. It is stated that the principal domestic ore deposits are in South Dakota, Colorado, Nevada, California and Arizona from which 30 percent of the domestic supply is produced.

The commission has before it applications for investigations looking to increased duties on tungsten, cast iron pipe, and graphite and prepared preliminary reports summarizing information as to

production and consumption in the United States and foreign countries, imports, exports, prices, costs of production, and other factors in competition to determine whether these investigations should be instituted.

The metals division of the commission has been investigating the duties on tungsten and manganese. It plans to develop tariff surveys in 300 metal commodities. Partial or complete revisions have been made of 35 commodity surveys relating to iron and steel, non-ferrous metals, manufacturers of metals and machinery. More than 50 metal tariff information summaries have been drafted. This data is for the use of Congress in possible revision of the schedules.

### J. D. Ryan Presents Butte With Airport

John D. Ryan, chairman of the Anaconda Copper Mining Company, on November 12, presented the city of Butte, Mont., with a new airport, which was built at a cost of \$25,000. The presentation was made by J. Carlos Ryan, a vice president of the Montana Power Company, in behalf of his father and was accepted by M. Kerr Beadle, mayor of Butte. The first plane to land on the new field was a large Fokker, piloted by A. W. Stephenson and containing as passengers Gov. John E. Erickson, J. C. Ryan, Mayor Beadle, United States Senator B. K. Wheeler and Alfred Frank, president of the National Park Airways.

Mr. Ryan has devoted a great deal of time and money to the furthering of commercial aviation during and since the war and is a member of the advisory board of Guggenheim Foundation of Aeronautics.

### To Reduce Vanadium Ore

Reduction of local vanadium ore is contemplated by the Vanadium Metals Corporation, Everett, Wash., recently incorporated for \$150,000. According to Alfred Stalberg, Everett chemist, who is president of the company, the vanadium trioxide found in local ores will be smelted with finely divided particles of iron. The iron, having an affinity for

oxygen, unites and leaves a metallic vanadium claimed to be unusually free from impurities. A plant is to be erected in Everett and electric furnace installation made.

### Mining Machinery Exhibit Planned at Los Angeles

Arrangements are being made in Los Angeles, in preparation for the Western States Metal and Machinery Exposition and Western Metal Congress, which takes place January 14 to 18.

W. H. Eisenman, secretary of the American Society for Steel Treating, is in charge of the affair, which will be held under the guidance of the society. The displays of metal and mining products will be held in the spacious Shrine auditorium, where two complete floors will be occupied, and the convention sessions will take place in the Biltmore hotel.

One entire division of the show will be allotted to mining machinery and equipment, it is said, in which will be featured drills, compressors, heat treating equipment and scores of other important items.

The American Institute of Mining and Metallurgical Engineers and the Chamber of Mines and Oils are cooperating with the steel treating society in the presentation of programs.

### Non-Ferrous Metallurgical Analysis

By Keffler and McNeil. McGraw-Hill Book Co., Inc., New York; \$4.

The authors, long associated in the chemical department of the Anaconda Copper Co., have detailed the latest practice in analytical methods, not only for metallurgical determination and estimation of impurities but giving also sections on alloys, and the elements ordinarily encountered in nonferrous metallurgy.

The work includes not only the authors' own methods but others obtained from authoritative sources, the whole having been edited by Professor Butts, of Lehigh University. Each chapter follows a uniform method of presentation, and the whole is well indexed.

### Commodore Iron Mine in Minnesota to Be Reopened

Employing approximately 60 men, the Commodore mine, located just north of Virginia, Minn., will be reopened for operations next spring by the Corrigan-McKinney Steel Company.

Preparatory work is now being rushed to completion so as to facilitate the shipping of ore immediately upon the opening of the season in the spring. According to present calculations the Commodore will be operated for at least three years and possibly longer.

The Commodore until recent years was one of the most active mines in the Virginia area, but was forced to shut down in 1924.

R. A. MacDonell, general superintendent of the Stevenson and St. Paul mines, at Keewatin, both of which are operated by the Corrigan-McKinney company, will also have charge of the Commodore, it is said.

### Susquehanna Iron Mine Gets New Equipment

The Susquehanna mine, one of the oldest properties on the Mesaba Range, will start a new method of mining ore from the deep pit located in Hibbing, Minn., according to an announcement made by officials of the company.

M. A. Hanna Company has let a contract for building equipment which has been worked out especially for the Susquehanna pit. Instead of the use of locomotives, one car in every ore train

will have a motor for driving purposes. Thus all the cars in the trains will have capacity to carry ore, including the motorized car, on which the attendant will ride. Current will be secured from what mining officials term a side arm trolley.

The Susquehanna pit is one of the deepest pits on the range, and because of the depth attained it was necessary to formulate new methods of getting the ore out.

### Canada Uses Planes in Mapping Surveys

Airplanes aided in the survey of 53,000 square miles in Canada during the current year, reports of the Canadian topographical survey show.

The work, carried on by Canada's department of interior in cooperation with the Royal Canadian Air Force, included photographing 22,000 square miles of territory from airplanes for map making purposes and 31,000 square miles of oblique photography.

Geological mapping, water power investigation, determination of pulpwood and lumber resources and the preparation of topographical maps were included in the projects which necessitated the photography of such vast areas from the air.

Vertical photography is employed when great detail is needed, while the oblique method is found satisfactory when maps on the scale of four or more miles to an inch are required.

### Leaching Process for Mercury Ores

A leaching process for the recovery of mercury is being worked out at the Great Northern mine in Siskiyou County, California, now known as the J. N. P. mine and owned by Lewis Aubrey, W. W. Young and Geo. James. A 50-ton plant is being installed which it is claimed will secure a higher recovery at lower cost and without danger of salivating. The property is 26 miles northwest of Yreka.

### Anaconda Increases Dividend Rate

Through the declaration of a quarterly dividend of \$1.50 a share, the capital stock of the Anaconda Copper Mining Company was placed recently on a \$6 annual basis, against \$4 previously. The new dividend is payable February 18 to share owners on record January 12.

### George Graham Rice Gets Sentence

George Graham Rice, erstwhile mining stock promoter, was sentenced December 21 to serve four years in the Atlanta Penitentiary and to pay a fine of \$5,000, following his trial in New York for using the mails to defraud in connection with the sale of stock in the Idaho Copper Corporation.

Walter K. Yorston, president of the Idaho Copper Corporation, who was tried with Rice, was sentenced to serve nine months in Westchester County Penitentiary.

The Wall Street Iconoclast, a magazine published by Rice for the purpose of



"Necessary Replacements"



"Post Office"

boosting stocks he was promoting, was fined \$10,000, and fine was suspended on the Idaho Copper Corporation with the warning that it would be imposed at once if the company engaged in any improper practices during the next five years.

#### Tri-State Company Builds A New Safety Can

A new safety can to be used to hoist and lower men working underground has been completed by the Commerce Mining and Royalty Company, Miami, Okla., according to Henry Giessing, safety engineer of the company, and was given a trial at the Grace Walker mine of the company the latter part of December.

The new can is enclosed, with a sliding door. It is 36 in. in diameter and a little more than 6 ft. in height. The bottom of the can is rounded so that it can not catch on any obstacle in the shaft.

#### Corrosion of Zinc

"Zinc and Its Corrosion Resistance," is the title of a pamphlet published by the American Zinc Institute, New York. The booklet presents in abstract form existing data on studies and tests, equipment and researches in the use of zinc in relation to corrosion. The publication was prepared by the Research Service, Inc., under the direction of the development of industry committee of the zinc institute. It is a resume and bibliography of the published material on the subject. An earlier publication by the National Research Council was used as the basis. The galvanizing committee of the zinc institute also assisted. The booklet gives a long list of chemicals and elements in alphabetical order, with a paragraph or two on each one as it affects zinc.

#### Copper Companies Increase Dividend Rates

Directors of the Utah Copper Company have declared a quarterly dividend of \$3, placing the stock on a \$12 annual basis against \$8 previously.

The Nevada Consolidated Copper Company, which is controlled by Utah Copper Company, has declared a quarterly dividend of 50 cents, placing the stock on a \$2 annual basis against \$1.50 previously.

Capital stock of the Magma Copper Company has been placed on a \$4 annual basis, against \$3 previously, through declaration of a quarterly dividend of \$1.

United States Smelting, Refining and Mining Company directors have authorized issuance of 219,447 additional common shares to common stockholders of record December 19, at \$55 a share, in ratio of five-eighths for each share held. The proceeds will be used to retire \$2,000,000 of 5½ percent debentures.

#### World Stocks of Zinc

World stocks of zinc are estimated by American Zinc Institute, Inc., at 71,000 metric tons on December 1, of which the United States accounted for 42,200 tons. More prosperous times for the industry are forecast for 1929.

#### Regulate Zinc Output

Delegates to the conference of European and American zinc industries at Brussels, Belgium, recently concluded an agreement by which production will be restricted as from January 1 along lines previously suggested by American producers.

#### Silver Production

The United States in November produced 4,658,000 fine ounces of silver, against 4,352,000 ounces in October, the American Bureau of Metal Statistics reports.

#### Dorothy Bill Mining Company Purchases Lease

C. C. Cole and associates, owners of the Dorothy Bill Mining Company, have purchased the Dobson lease, consisting of 160 acres and a mill, near Hockerville, Okla., from the Federal Mining and Smelting Company. No consideration was announced. The Cole interests had an option on the property for several months, during which time a large amount of drilling was done on the lease, the results of which are said to have been highly satisfactory. The Dobson lease is just southwest of Hockerville and adjoins the Farmington lease of the Dorothy Bill Company.

#### Seven Big Copper and Brass Firms Figure in Merger

Directors of the Rome Brass and Copper Company early in December approved a plan to merge with six other companies to form a corporation to be known as the General Brass Corporation. The merger is expected to bring 20 percent of the country's brass and copper under the control of the corporation.

Under present plans, each of the constituent companies will be represented on the executive committee of the corporation. Factories of the individual companies will continue operation, with the management unchanged.

The companies with which the Rome concern is merging are: Taunton-New Bedford Copper Company, Taunton and New Bedford, Mass.; the Baltimore Sheet Mill of the General Cable Company; the Rome Manufacturing Cable

Company; the Michigan Brass and Copper Company of Detroit; Higgins Brass and Manufacturing Company of Detroit and the Dallas Brass and Copper Company, Chicago.

#### St. Louis Smelting & Refining Buys Missouri Zinc Property

The St. Louis Smelting and Refining Company has purchased the Schulte Mining Company of Fredericktown, Mo. The deal was pending for several months.

Drilling on the property was started in March, 1927. When it was ascertained lead ore in paying quantities was available, a 200-foot shaft was sunk and a tunnel is now being driven. The property, which includes about 775 acres about three miles south of Fredericktown, was partially developed several years ago.

#### Gogebic Iron Range Surveys to be Published

Data obtained through a diagnosis of structural features of the earth in Northern Wisconsin are being incorporated in a map of the Gogebic iron range by H. R. Aldrich, assistant state geologist of Wisconsin. The map, and a report of six summers' work, will appear in the next bulletin of the Wisconsin Geological and Natural History Survey.

Students at the state university specializing in geology made the field surveys in this region under the direction of Mr. Aldrich.

Although simple in construction and limited in sensitivity, the instruments, Mr. Aldrich said, have revealed the bed rock situation in a region in which, because of the almost complete blanket of glacial drift, little if anything beyond mere assumption could otherwise have been learned.

When by careful magnetic observations, either with or without the aid of outcrops, an iron-bearing formation has been traced out, it is not at all certain that iron ore exists in commercial quantities, Mr. Aldrich explained. But the chances are probably better than one in five that merchantable ore exists along the line of magnetic attraction if it is many miles in length and has good characteristics.

"There is no iron range in the Lake Superior District which does not show at least mild attractions on or near the iron formation," Mr. Aldrich said.

The instruments used in making magnetic observations in the Lake Superior region are the dial compass and dip needle. The dial compass, consisting of a portable sun dial, was devised in work in the Florence and Gogebic iron ranges

in Wisconsin. The dip needle consists of a thin, light, magnetic needle swung on a pivot, the ends of which rest in jeweled cups.

When the surveying students go into the field, and area is first examined with attention to the broader surface features, that is the "lay of the land" in perspective. Leveling instruments are brought into use and control lines are run wherever access is convenient.

Notes are taken as to major features and exposures of the bed rock, which are encountered and studied. Following this preliminary survey comes the detail survey conducted by traversing all north-south section lines. The students work in pairs and locations are tied to corners established by Government surveys.

Starting from these Government corners parties of two students take magnetic observations at regular intervals of 50 paces, or 40 to the mile. One man, guided by a sun dial compass by which a true north-south line can be followed, follows the line and maintains the location by placing. The second man reads the magnetic dip needle and systematically records observations.

In 1926 the survey covered an area of 430 square miles with the dip needle, and in 1927, 608. In the last 18 years a total of 267 townships in Wisconsin have been surveyed.

#### Supreme Court Dismisses Iron Ore Royalty Case

By dismissing appeals of the Vermilion Mining Company, Crete Mining Company and Inland Steel Company, the United States Supreme Court sustained the 6 percent tax of Minnesota on iron ore royalties paid by the mining company lessees. The companies in a test case, claimed that the tax should be paid by the landowners. Their appeals from the Minnesota court which sustained the tax against them, were dismissed by the Supreme Court without a written opinion, on the authority of the court's former decision in a similar case involving the tax brought by the Lake Superior Consolidated Iron Mines.

#### Murray M. Duncan Dies

Murray Morris Duncan, vice president of the Cleveland-Cliffs Iron Company, and member of the American Mining Congress, died at his home in Ishpeming, Michigan, December 17. He had been in poor health for nearly four years and for several weeks before his death gradually grew worse until the end came peacefully.

#### Tariff Revision Hearings

Tariff revision hearings are to be held by the House Committee on Ways and Means commencing January 7, on 15 schedules of the tariff law. The metal schedules are up for discussion on January 14, 15 and 16. Tariffs on earthenware and glassware are on the program for January 10 and 11.

#### Creates Market Research Institute

The new Executive Committee of the National Coal Association, at its first meeting since the Annual Meeting, created the Market Research Institute of the association by correlating the activities of a number of committees. The Market Research Institute will serve as an overlying committee tying together the activities in Cost Accounting, Trade Relations, Trade Practices, Publicity, Commercial Research, and Industrial or Technical Research, and will be under the general chairmanship of Walter Barnum, President of the Pacific Coast Company, 250 Park Avenue, New York City, and former President of this association. Thus there will be segregated and correlated all the activities of the association pertaining to the marketing side of the industry. Announcement of the individual chairmen of the various committees correlated in the Market Research Institute will be made later.

#### Canada Not Dependent on American Anthracite

Canada no longer is entirely dependent upon the United States for her fuel supplies, but has "a superabundance of foreign and native fuels for all purposes," the second progress report of the Dominion Fuel Board, made public December 18, said:

"Though still using large quantities of American anthracite, we are no longer dependent on this fuel, the producers of which are now fighting here to retain a declining market, as they are in their own country."

#### Less Coal Mined in Pennsylvania

Decreasing production of both anthracite and bituminous coal in the state this year below 1927 is indicated in the monthly report of mine inspectors to Walter H. Glasgow, secretary of mines.

In announcing the figures for the 11 months of this year Mr. Glasgow said there is slight probability that the 1928 production will equal last year's. The estimated production last year was 79,644,000 tons of anthracite and 13,150,000 of bituminous.

The hard coal mined up to the close of November was estimated at 55,500,000

tons and the bituminous production had reached 102,101,000 tons. Last month's production figures were — anthracite, 6,000,000 and bituminous 10,250,000.

#### Large Attendance at Monongahela Coal Institute Banquet

More than 350 representatives of practically every coal mine in northern West Virginia and many in Pennsylvania attended the second annual banquet of the Monongahela Valley Coal Institute held in Morgantown, December 15. Harry C. White, of the Edison Lamp Works, General Electric Co., Harrison, N. J., and Frank M. Gans, cashier of the People's National Bank of Point Marion, were major speakers of the evening.

J. K. Buchanan, general manager of the Morgantown office of the Monongahela West Penn Public Service Co., acted as toastmaster.

A Pittsburgh company presented a vaudeville program at the close of the banquet.

#### F. E. Learned to Have Charge of Philadelphia & Reading Operations

In accordance with action taken by the Board of Directors of the Philadelphia and Reading Coal and Iron Company at a meeting held November 22, Frank E. Learned, who had been assistant to the president, was appointed vice president in charge of colliery operations.

Mr. Learned is to have direct charge of all the mining operations of the company, including the lands, the shops and all property of the company in the anthracite region. He will also have such other duties as may be assigned to him from time to time by the president.

#### Improvement Shown in Coal Production

Improvement is under way in the coal-producing areas of the United States, with production nearing normal again, and with demand for the winter season strong, the Brookmire Economic Service, Inc., states. In nearly all of the coal centers a gain in production of coal over last year was registered. In Pennsylvania production is up 13 percent, in West Virginia 4 percent, Maryland 5 percent. Ohio leads the list, in point of gain over last year, with 155 percent. A favorable factor offsetting this large production is the fact that consumers' stocks have been allowed to drop to subnormal levels. The outlook for distribution is favorable, especially in contrast to 1927.

**Lake Cargo Cases May Be Reopened As Effective Date for New Differentials Nears**

Restoration of the 45-cent freight rate differential on northern and southern Lake Cargo coal shipments is the objective of the Pittsburgh Coal Operators' Lake Rate Committee, which on December 15 protested the compromise rate of 35 cents fixed by the carriers.

The protest was filed before the Interstate Commerce Commission and it is expected to result in a reopening of the Lake Cargo controversy, which was waged for several years between northern and southern coal interests.

The Pittsburgh operators said they wanted the 45-cent differential restored. Later a like protest was filed by the operators of Eastern Ohio, which is considered a part of the northern field. The compromise differential was scheduled to become effective at midnight December 31.

On December 22 four southern carriers—the Norfolk & Western, Virginia, Louisville & Nashville and Chesapeake & Ohio—notified the commission that they objected to any reductions northern railroads might make to meet the requirements desired by northern mine interests.

Early this year, the Interstate Commerce Commission ordered a differential of 45 cents a ton between northern and southern shipments. Previously the rate had been 25 cents a ton lower than the South.

Then railroads serving southern mines announced a reduction which restored the 25-cent rate. The I. C. C. prohibited the southern carriers from placing the rate in effect, but a Federal district court injunction nullified the commission's suspension order. The commission appealed to the Supreme Court of the United States against the restraining order, but arguments have not yet been held.

**Campaign on to Increase Coal Exports**

A campaign to increase the coal export trade has been launched by the Coal Exporters' Association of which Arthur Hale is chairman. At a meeting in New York the association adopted the following resolution to increase the exportation of coal for the benefit of the whole industry:

"WHEREAS the export of coal is of extreme interest to the entire coal industry; and

"WHEREAS the Committee on Appropriations of the House of Representatives is considering the Shipping Board appropriation; and

"WHEREAS the railroads are considering an export rate: Be it

"Resolved, That every coal exporter and every coal association interested urge their Senators, Congressmen and railroads to take action to encourage the export of coal."

Chairman Hale has asked traffic executives of eight railroads producing export coal to establish a proper export rail rate. It is understood this matter has been discussed by coal traffic officers of the railways and that they will take it up officially.

As the Shipping Board will not spend all of the million dollars appropriated for coal exports before June 30, hearings on a further appropriation will be held shortly by the Committee on Appropriations of the House of Representatives.

**L. W. Mitchell Becomes Secretary of Southern Wyoming Coal Operators' Association**

L. W. Mitchell, of Kansas City, Mo., has accepted and will shortly assume the position of secretary of the Southern Wyoming Coal Operators' Association. Heretofore that association has been purely a labor organization, but it was recently decided by its members to make it into a trade association. Various candidates for the secretaryship were canvassed and Mr. Mitchell selected.

**New Secretary for Utah Coal Operators' Association**

At a meeting of the Utah Coal Operators' Association on December 4, Oliver J. Grimes, of Salt Lake City, was elected secretary of that association. He has a number of years' experience as a newspaper man, spent a considerable length of time in railroad service, and has been private secretary to several governors of the State of Utah.

**Mt. Lookout Colliery Abandoned—Operated Since 1888**

The Mt. Lookout colliery at Wyoming, Pa., is being abandoned, according to an announcement by W. P. Jennings of Scranton, president of the Mt. Lookout Coal Company, after 40 years of operation. Work of dismantling the colliery started on December 1 and will be completed in about three months.

Mr. Jennings stated that "cost of operation has been too high, royalty being the main factor. The royalty we have been paying has been 20 percent of the selling price. The colliery was opened in 1888 and has always been expensive to operate. During 1927 it was worked every day with the idea of finding a solution to the problem, but the effort resulted in failure."

Rails are being taken from the gangways in the mine and outside machinery

is being shipped to other operations of the company. As soon as the rails have been removed work of removing electric pumps will be started and the workings allowed to fill with water.

Mt. Lookout Coal Company is an independent operation, stock being owned by Temple Coal Company. Approximately 450 workers were employed at the colliery.

**Glen Alden Purchases West Nanticoke Mine**

Confirmation of the sale of the Grand Tunnel Coal Company holdings at West Nanticoke, Pa., to Glen Alden Coal Company was made recently by W. W. Inglis, president of the latter concern. The consideration is said to have been \$200,000. Glen Alden Coal Company operates the Avondale Colliery, which adjoins Grand Tunnel, and reports state that Grand Tunnel was bought as a precautionary method to prevent flooding of Avondale.

Susquehanna Collieries Company acquired Grand Tunnel in 1921 and a year later sold it to Grand Tunnel Coal Company. The colliery has been idle since November 28. Normally about 400 men are employed at the colliery.

**W. J. Rainey, Inc., Purchases Coal Lands**

W. J. Rainey, Inc., has purchased from J. H. Hillman, Jr., of Pittsburgh, a tract of 3,000 acres of by-product coking and gas coal, comprising the Hillman Clarksdale operations and other coal lands adjoining Rainey's Clyde mine, in Washington and Green Counties, Pa. The purchase will give Rainey approximately 7,000 acres of coal in one tract, with both river and rail connections.

**Large Mine in Pittsburg, Kans., Coal Field Reopens**

The Western Coal & Mining Company's mine No. 22, said to be the largest in the Pittsburg, Kans., field, was reopened early in December.

The mine is located near Arma, 10 miles north of Pittsburg. It was closed last April because of the strike. More than 300 men were employed in the mine at the time of its closing.

John D. Beatty has succeeded Edward Steidle as secretary of the Mining and Metallurgical Advisory Board at the Carnegie Institute of Technology. Mr. Steidle is now Dean of the School of Mines and Metallurgy of Pennsylvania State College, State College, Pa.

James H. Pierce, of the firm of Stuart, James & Cooke, Inc., engineers of New York, will leave early in January for England and Russia to look after the firm's increasing foreign work.

**Repeal of Pennsylvania Anthracite Tax Asked By Philadelphia Chamber of Commerce**

Repeal of the anthracite sales tax at the coming session of the Pennsylvania Legislature was urged December 15 in a resolution passed by the board of directors of the Philadelphia Chamber of Commerce.

The board's action followed consideration of information developed in a comparative study of the anthracite situation by the chamber's committee on taxation and mutual expenditure.

The board held that the prosperity of the entire state as well as that of the city of Philadelphia has been hurt by the heavy burden of taxation placed on the hard-coal business.

The anthracite tax, the board points out, originally was an emergency measure and maintains that the need for it has disappeared.

Other states deeply resent continuance of the tax, according to the board, and this led to distinct movements to curtail use of anthracite.

Hard coal is bearing the heaviest burden of taxation in Pennsylvania, the board says. This amounts to 41 percent of the net income in some instances.

"The anthracite sales tax is uneconomic in that it lays a special burden upon one industry without taxing other industries which are in direct competition with it," the statement said. "The anthracite sales tax was imposed by the legislature on the theory that anthracite was a natural monopoly of the state, and that it was also a necessity. Everyone will concede that anthracite is a natural monopoly, but the rapid development of substitutes, such as oil, coke, bituminous coal, etc., indicates clearly that it can not be considered as an absolute necessity. The effect of the tax has been to encourage the use of substitutes, and hence to reduce the natural and legitimate business of the industry. No tax should be levied upon one branch of a competitive industry unless all other branches are subjected to the same tax."

Anthracite coal is one of the premier industries of the state. It employs 158,000 men and represents an output of over \$400,000,000 per year. For many years a large proportion of its sales was in states other than Pennsylvania. When the anthracite sales tax was enacted by Pennsylvania a deep resentment arose among other communities, such as New England and the Middle West,

where the people had been accustomed to use anthracite coal as fuel, and liked to use it, because they felt that Pennsylvania was unfairly taxing them. As a result, the export trade in anthracite has been reduced materially. It is a mistake to allow an industry which has large export possibilities to become the subject of local prejudice which will interfere with its export trade. This trade may well become a back-log to support the industry in times of depression."

**Southern Appalachian Coal Operators' Assn. Meets at Knoxville**

A large attendance marked the Sixteenth Annual Meeting of the Southern Appalachian Coal Operators' Association, held December 7, at Knoxville. Great interest was evinced in the trade practice movement and on motion of J. E. Butler, general manager, Stearns Coal & Lumber Co., Stearns, Ky., the president was authorized to name a Trade Practice Committee to develop a practical program.

The following officers were re-elected: V. N. Hacker, president, Pruden Coal & Coke Co., Knoxville, president; C. M. Moore, president, Moore Coal Co., Knoxville, first vice president; C. W. Rhodes, vice president and general manager, Fork Ridge Coal & Coke Co., Middlesboro, Ky., second vice president, and R. E. Howe, of Knoxville, secretary-treasurer. The new Board of Governors is J. E. Butler; John L. Boyd, president, Buffalo Coal Co., Knoxville; Alex Bonnyman, chairman of the board, Blue Diamond Coal Co., Knoxville; E. C. Mahan, president, Southern Coal & Coke Co., Knoxville; C. W. Henderson, presi-

dent, Cambria Coal Mining Co., Knoxville; J. B. Gatliff, president, Gatliff Coal Co., Williamsburg, Ky.; George R. Wood, vice president, Old Straight Creek Coal Corp., Pineville, Ky.; W. G. Polk, secretary, Block Coal & Coke Co., Knoxville; S. M. Reams, Clearfork Coal Co., Inc., Middlesboro, Ky.; Robert S. Young, secretary-treasurer, Blue Diamond Coal Co., Knoxville, and W. R. Peck, general manager, Black Diamond Collieries, Coal Creek, Tenn.

Two hundred and twenty-five operators and railroad men attended the banquet at the Cherokee Country Club, at which Judge H. B. Lindsay presided, and addresses were made by Governor Horton, of Tennessee, and C. B. Huntress, of the National Coal Association.

**Mine Union Official Joins Indiana Operators' Association**

Harvey Cartwright, for the last two years president of District 11, United Mine Workers of America, tendered his resignation December 6, effective at once.

Mr. Cartwright has accepted a position as executive secretary of the Indiana Bituminous Coal Operators' Association, formed recently to take the place of the organization dissolved some months ago, upon the retirement of Phil H. Penna, Terre Haute operator, who then was executive secretary.

James H. Terry, vice president, will succeed Mr. Cartwright.

**American Mine Owners' Casualty Corporation Formed**

Organization of the American Mine Owners' Casualty Corporation under Pennsylvania laws, to acquire and take over the casualty insurance business heretofore controlled by the Insurance Management Corporation, was announced December 18 by Evan I. Reese, president of the new corporation. This business was formerly placed with stock and mutual insurance companies by the Insurance Management Corporation, which latter company will control a substantial interest in the new organization. This management company has been engaged in this type of insurance underwriting for 12 years.

The corporation is now licensed in Alabama, Illinois, Indiana, Kentucky, Pennsylvania and Virginia, and is under the supervision of the Pennsylvania Insurance Department. Its capitalization will consist of 40,000 shares of \$10 par value capital stock.



Can't Enjoy It For Worrying

# WITH THE MANUFACTURERS

## Roberts and Schaefer Twenty-fifth Anniversary

In celebrating the twenty-fifth anniversary of the Roberts and Schaefer Company, engineers and contractors, Chicago, the fact was brought to light that of some 150 employees only five of the original members of this organization are still actively engaged in the work of their company as it reaches the quarter century mark.

These individuals, each with 25 consecutive years of service, are Col. Warren R. Roberts, chairman of the board; Mr. John J. Roberts, president; Mr. Frank E. Mueller, first vice president; Mr. Clyde P. Ross, second vice president; and Mr. R. G. Lawry, construction engineer. They are all well known to the industry. Some of their experiences of the past 25 years will be recorded in a booklet soon to be released, copies of which may be secured by writing direct to the company offices, Wrigley Building, Chicago.

## "Cardox" Approved By Bureau of Mines

The Safety Mining Company, of Chicago, has announced the approval of "Cardox" by the United States Bureau of Mines as a permissible blasting device, approval No. 1. "Cardox" is thereby not classed as an explosive. It will not ignite gas or dust in any possible manner in a mine in its assembled form.

In its announcement the company states:

"This means that the hazard of mine explosions and local accidents always potentially present where explosives are used can be definitely lessened by adoption of a non-explosive agent for breaking down coal. 'Cardox' also increases lump coal production, prevents roof shattering, and promotes ease of loading by doing a better job in freeing the coal at the face.

"An advance in mining practice which promotes safety, more than pays its way, and requires a moderate investment, is unusual and is attracting wide attention."

## Cutler-Hammer Atlanta Office Moves

On December 1 the Atlanta office of the Cutler-Hammer Mfg. Co., moved into new quarters at 150 Peters St., S. W., Atlanta, Ga. In addition to sales and engineering service on Motor Control Ap-

paratus and Wiring Devices, the new location provides warehouse facilities where many types of standard devices will be carried in stock for direct shipment to customers in that territory. A. C. Gibson is manager in charge of the Atlanta office.

## Du Pont Makes Film of Cascade Tunnel Construction Work

E. I. du Pont de Nemours & Company has just completed a one-reel motion picture showing the construction work on the Cascade Tunnel, which is being driven through the Cascade Range in the State of Washington for the Great Northern Railway. This is the second of their engineering films, the first of which was "Building New York's Newest Subway."

This film, which is called "Driving the Longest Railroad Tunnel in the Western Hemisphere," should prove of more than ordinary interest, as it shows many of the important construction problems faced by the builders. This work is still in progress, as the tunnel will not be opened until early in 1929.

This is one of the great engineering jobs of the present time, and one on which the world's record for tunnel driving has been broken. The film shows, through animated drawings as well as through actual pictures, how the four working faces were developed, how water problems were taken care of, how the mucking, hauling and drilling operations were carried on and how other difficulties in construction were met.

*The Marion Diesel-Electric*

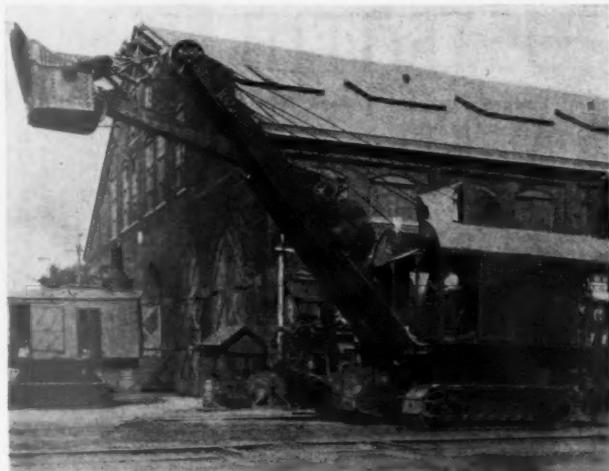
## The Marion 480 Line

The Marion Steam Shovel Company announces the introduction of a new group of 2 cu. yd. shovels—the type 480, all of the same general construction and capacity. They are built with three types of primary power supply. The one following the longest line of historic precedent is the steam powered 480. Another is the electric 480. The last and latest, the carefully engineered and fully tested Diesel-Electric 480.

With 25-ft. railroad shovel type boom—combination wood and steel, with 17-ft. inside dipper handle—also wood and steel and 2 cu. yd. dippers they follow closely the designs of the Marion Type 37. The new 480, however, is heavier, more rugged, more powerful, with better balance.

The Diesel-Electric, illustrated here-with, is a new development. A Winton Diesel engine direct connected to a direct current "drooping voltage" generator supplies the power for the electric motors, which are geared individually to hoist, swing, and crowd. From generator to dipper the Diesel-Electric is a duplicate of the electric. The Diesel engine horsepower is 150 at 750 r. p. m. The generator is 50 kw. and the hoist motor is 90 horsepower 60 min. rating, while swing and crowd motors are 30 horsepower.

The Diesel is a 6-cylinder 7 in. x 8½ in., 4-cycle airless injection engine. An auxiliary gasoline engine driven-air compressor is also provided, as are necessary fuel oil tanks, air tanks, pumps.



### Carbide Light Gives You Your Choice of Fuels

The Alexander Milburn Company, of Baltimore, announces a new kind of carbide light which will especially operate with either lump carbide or carbide cakes. This addition to the Milburn line is to provide a light or welding generator, with extra gas storage space and which does not restrict the user to any particular kind of carbide.

### New Ingersoll-Rand Compressor

Ingersoll-Rand Co., 11 Broadway, New York City, announces a new, direct-connected, gas-engine-driven compressor. It is designated the Type XG, and is being introduced following several years of development under actual operating conditions. It consists of a 2-cylinder, 4-cycle gas engine, direct connected to Ingersoll-Rand compressing cylinders with L-R plate-type valves.

Features of the XG are its rugged construction, accessibility of frames and running gear, and economy of floor space and foundation requirements. The compression end can be furnished to accommodate any of the usual conditions of pressure range. The XG is adapted to continuous service in the oil and gas industries or to general industrial use. It is described in Bulletin 3149, available on request to the company.

### Timken Establishes New Offices

Through a reorganization affecting its Pacific coast territory, the Timken Roller Bearing Company has established two new permanent offices, one in Los Angeles, Calif., and one in Seattle, Wash. The former will be in charge of Roy Cross, with address at 1361 South Figueroa Street, Los Angeles, and the latter in charge of Marshall Cooleedge, with address at 321 East Pine Street, Seattle. G. C. McMullen remains as district manager at the company's San Francisco office.

### Miami Copper Company Orders New Apparatus

The Miami Copper Company has placed an order for new switching apparatus with the Westinghouse Electric and Manufacturing Company. The order calls for 13 electrically operated, type "B-32" oil circuit breakers, together with supporting frame, disconnecting switches, copper bus and connections, bus bar supports, instrument transformers and bolted steel structures. This apparatus controls 13 circuits—7, 600 ampere; 4, 800 ampere; and 2, 1,600 ampere.

The frame and equipment is being completely assembled at the works and will

then be disassembled and shipped to customer. All parts are completely fitted, as the structure is to be erected within 6 in. of the present structure, which it will supersede. When the new equipment has been entirely installed, then the old structure will be dismantled and removed with practically no interruption of the service.

### Electricity in Mines

The General Electric Company has issued a review of electrical development in the mining industry in 1928, prepared by F. L. Stone of its industrial engineering department and K. H. Runkle of its industrial department. Electrification by the Utah Copper Company of its Bingham, Utah, Mining properties is described as the feature of the year. Developments of electric shovels, hoists and conveyors and permissible motors are reviewed. The review describes an electric hoist at the mine of the Peabody Coal Company at Springfield, Ill., and fabricated steel frame induction motors for hoisting at the Oliver Iron Mining Company. It also tells how the H. C. Frick Company is using electric conveyors for transporting coal from mines to river docks.

### Sirocco Unit Heater Catalog No. 7418

The Sirocco Unit Heater is the latest addition to the list of American Blower products. It has been designed with the requirements of the International Plant Heating System uppermost in the minds of the Engineers responsible for it.

A catalog which tells the "A. B. C." of the unit and its construction, is available. It is fully illustrated and contains a vast amount of information upon Unit Heaters.



One of the Western Electric telephone sets distributed by the Graybar Electric Company, of New York. A bulletin describing the telephones and accessories was reviewed in our November issue.

### Bulldog Sling Now Available in Larger Size

The O-B Bulldog Feeder Sling for supporting feeder cable on insulated hangers, formerly made to take only 500,000 c. m. and 1,000,000 c. m. cable, is now being made for 750,000 c. m. cable, according to the Ohio Brass Company, Mansfield,



O. B. Bulldog feeder sling

Ohio, manufacturers. As in the case of the other sizes, this sling is made with one large curved jaw and a smaller jaw which clamp the feeder wire when the nut is tightened. The large jaw acts as a support while the feeder wire is being strung. The device is made of O-B Flecto malleable iron, hot-dip galvanized.

### Sweet's Steel Company

Samuel C. Rebman, who has represented the Sweet's Steel Company in the capacity of district sales manager in the Pennsylvania anthracite coal fields, is now transferred in the capacity of sales manager to the branch office of this company, located at 274 Madison Avenue, New York City.

Hugh G. Daley, formerly with the Carnegie Steel Company, has been appointed sales manager in charge of the Pennsylvania anthracite coal fields, and he will hereafter be located in the company's branch office, 734 Land Tile Bldg., Philadelphia.

### B. E. Schonthal & Co.

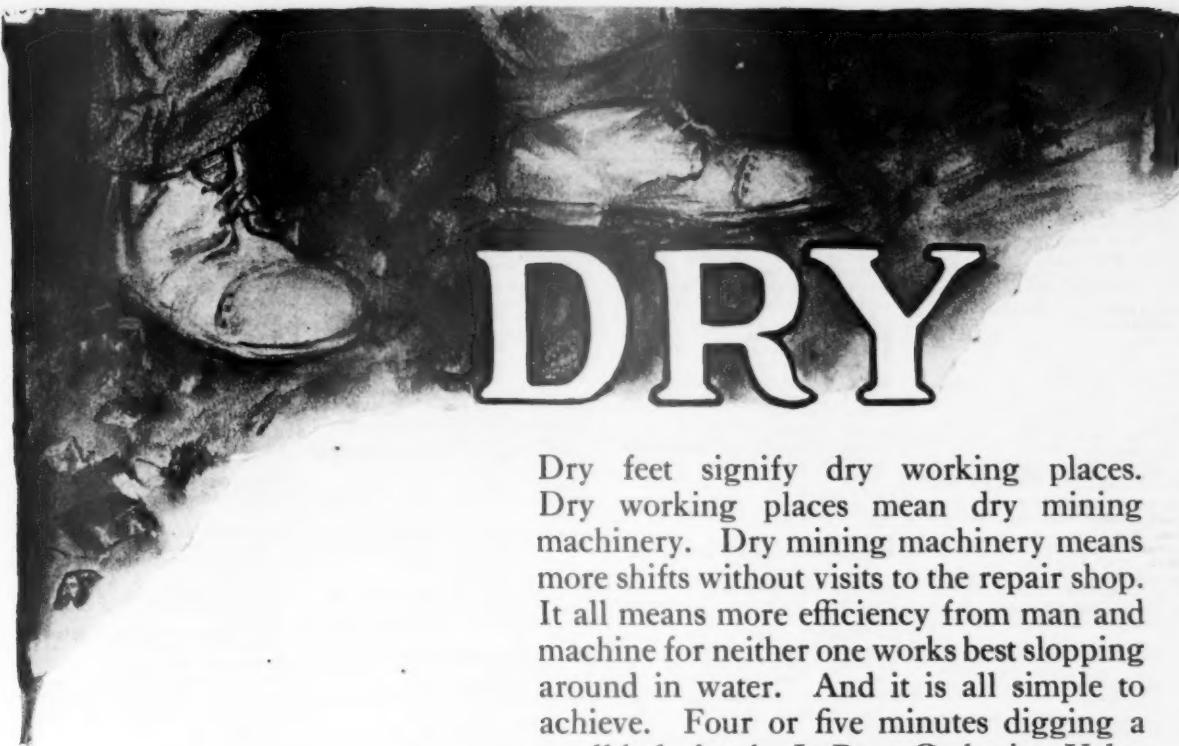
B. E. Schonthal & Co., Inc., of Chicago, are now representing the following mining equipment manufacturers through their mechanical department:

The Illinois Power Shovel Co., of Nashville, Ill., makers of the Clarkson Loading Machine and Conway power shovel, for the loading of coal and rock; also for cleaning roadway, air courses, and grading in mines.

The Chicago Automatic Conveyer Co., of Chicago, manufacturers of the "Red Devil Shovel End Pit Car Loader" and belt conveyors.

The Conveyer Sales Co., Inc., of New York City, manufacturers of the well-known "Cosco" shaker conveyor.

The Electric Storage Battery Company recently announced the appointment of Albert N. Dingee as Advertising Manager to succeed the late Alfred B. Kreitzburg. Mr. Dingee has been in the Sales Department of the company for the past 18 years.



# DRY

Dry feet signify dry working places. Dry working places mean dry mining machinery. Dry mining machinery means more shifts without visits to the repair shop. It all means more efficiency from man and machine for neither one works best slopping around in water. And it is all simple to achieve. Four or five minutes digging a small hole for the LaLabour Gathering Valve does the trick. This operates entirely automatically when connected to the LaLabour Centrifugal or any other pump capable of handling small amounts of air. The same pump will operate several valves even if they are on different levels.

Let us give you information describing these gathering valves and their low cost.

THE LABOUR COMPANY  
CHICAGO HEIGHTS, ILLINOIS



A few minutes  
with the LABOUR  
GATHERING VALVE  
did it . . . . .

---

ELCOMET IS A METAL HIGHLY RESISTANT TO ACIDS AND ALL CAUSTIC

# BUYER'S DIRECTORY

**ACETYLENE, Dissolved**  
(Or in Cylinders)  
Prest-O-Lite Co., Inc., 30 E. 42d St., New York City.

**ACETYLENE GAS**  
Prest-O-Lite Co., Inc., 30 E. 42d St., New York City.

**ACETYLENE GENERATING APPARATUS**  
Oxweld Acetylene Co., 30 E. 42d St., New York City.

**ACID, SULPHURIC**  
Irvington Smelting & Refining Works, Irvington, N. J.

**AERIAL TRAMWAYS**  
American Steel & Wire Co., Chicago and New York.

**AFTERCOOLERS (Air)**  
Ingersoll-Rand Co., New York City.

**AIR COMPRESSORS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

**AIR COMPRESSOR OILS**  
Standard Oil Co. (Ind.), Chicago, Ill.

**AIR FILTERS—Bag type**  
American Coal Cleaning Corp., Welch, W. Va.

**AIR HEATERS**  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**AIR LIFT PUMPING**  
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

**ANNUNCIATOR WIRES & CABLES**  
John A. Roebling's Sons Co., Trenton, N. J.

**ANNUNCIATOR WIRES & CABLES, INSULATED**  
American Steel & Wire Co., Chicago, Ill., and New York.

**ANTI-RUST OILS & GREASES**  
Standard Oil Co. (Ind.), Chicago, Ill.

**ARMATURE COILS & LEADS**  
General Electric Co., Schenectady, N. Y.

John A. Roebling's Sons Co., Trenton, N. J.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**ARMORGRIDS**  
Hendrick Mfg. Co., Carbondale, Pa.

General Electric Co., Schenectady, N. Y.

**ASPIRATORS**  
American Coal Cleaning Corp., Welch, W. Va.

**AUTOMATIC CAR & CAGER STOPS**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

**AUTOMATIC CAR CAGES**  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

**AUTOMATIC CAR DUMPERS**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

**AUTOMATIC FLAGGING SIGNALS**  
American Mine Door Co., Canton, Ohio.

**AUTOMATIC (Mine Doors, Trucks and Electric Switches)**  
American Mine Door Co., Canton, Ohio.

**AUTOMATIC MINE SWITCHES**  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**AUTOMATIC SWITCH THROWERS**  
American Mine Door Co., Canton, Ohio.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**AUTOMOBILE CABLES**  
John A. Roebling's Sons Co., Trenton, N. J.

**BAG TYPE AIR FILTERS**  
American Coal Cleaning Corp., Welch, W. Va.

**BALLAST UNLOADER ROPES**  
John A. Roebling's Sons Co., Trenton, N. J.

**BALL BEARINGS**  
S K F Industries, 40 E. 34th St., New York City.

**BALL & ROLLER BEARINGS**  
S K F Industries, 40 E. 34th St., New York City.

**BARS, STEEL**  
Carnegie Steel Co., Pittsburgh, Pa.

Timken Roller Bearing Co., Canton, Ohio.

**BATTERIES**  
E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del.

**BATTERIES, ARMATURE**  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**BATTERIES, BLASTING**  
Hercules Powder Co., Wilmington, Del.

**BATTERIES, DRY (for Bells, Buzzers, Signals, Blasting)**  
National Carbon Co., Inc., 30 East 42nd St., New York City.

**BATTERIES (Storage, Gas Welding, Cutting, Dissolved Acetylene)**  
Prest-O-Lite Co., 30 East 42d St., New York City.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**BEARINGS**  
S K F Industries, 40 E. 34th St., New York City.

**BEARINGS (for all kinds of equipment)**  
Hyatt Roller Bearing Co., Newark, N. J.

**BEARINGS, ANGULAR CONTACT**  
S K F Industries, New York City.

**BEARINGS, ANTI-FRICTION**  
S K F Industries, New York City.

**BEARINGS, ARMATURE**  
S K F Industries, New York City.

**BEARINGS, AUTOMATIC**  
S K F Industries, New York City.

**BEARINGS, BALL**  
S K F Industries, New York City.

**BEARINGS, JOURNAL, CAR & LOCOMOTIVE**  
S K F Industries, New York City.

**BEARINGS, MOTOR, ELECTRIC**  
S K F Industries, New York City.

**BEARINGS, RADIAL**  
Timken Roller Bearing Co., Canton, Ohio.

S K F Industries, New York City.

**BEARINGS, ROLLER**  
S K F Industries, New York City.

**BEARINGS, SHAFT, SELF-OILING**  
S K F Industries, New York City.

**BEARINGS, TAPERED ROLLER**  
Timken Roller Bearing Co., Canton, Ohio.

**BEARINGS, THRUST**  
S K F Industries, New York City.

Timken Roller Bearing Co., Canton, Ohio.

**BELL CORD**  
John A. Roebling's Sons Co., Trenton, N. J.

**BELT DRESSING**  
Standard Oil Co. (Ind.), Chicago, Ill.

**BELTING (Conveyor, Elevator, Transmission)**  
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**BELTING, SILENT CHAIN**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

**BINS (Coke and Coal)**  
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**BORITZ**  
R. S. Patrick, Sellwood Building, Duluth, Minn.

Diamond Drill Carbon Co., World Bldg., New York.

**BRAKES, GAUGE**  
Central Frog & Switch Co., Cincinnati, Ohio.

**BRAKES, RAIL**  
Central Frog & Switch Co., Cincinnati, Ohio.

**BRAKES, TRACK**  
Central Frog & Switch Co., Cincinnati, Ohio.

**BRAZILIAN ROCK CRYSTAL**  
Diamond Drill Carbon Co., World Bldg., New York.

**BREAKER MACHINERY**  
American Rheolaveur Corporation, Wilkes-Barre, Pa.

Vulcan Iron Works, Wilkes-Barre, Pa.

**BREAKERS**  
American Coal Cleaning Corp., Welch, W. Va.

**BREAKERS (Construction and Machinery)**  
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

**BREAST MACHINES**  
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

**BRICKETTING MACHINERY**  
Vulcan Iron Works, Wilkes-Barre, Pa.

**BRUSHES (Carbon, Graphite and Metal Graphite for Electric Motors, Generators and Converters)**  
National Carbon Co., Inc., Cleveland, Ohio, and San Francisco, Calif.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**BUCKETS (Elevator)**  
Hendrick Mfg. Co., Carbondale, Pa.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**CABLE COMPOUNDS**  
Standard Oil Co. (Ind.), Chicago, Ill.

**CABLE GREASE**  
Keystone Lubricating Co., Philadelphia, Pa.

**CABLES**  
American Steel & Wire Co., Chicago and New York.

Roebling's Sons Co., John A. Trenton, N. J.

**CABLES (Connectors and Guides)**  
American Mine Door Co., Canton, N. Y.

**CABLES, INSULATED**  
General Electric Co., Schenectady, N. Y.

John A. Roebling's Sons Co., Trenton, N. J.

**CABLES, SUSPENSION BRIDGE**  
John A. Roebling's Sons Co., Trenton, N. J.

**CABLEWAYS**  
American Steel & Wire Co., Chicago, Ill., and New York.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**CAGE DUMPERS, ROTARY**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

**CAGES (Safety Appliances)**  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

**CAGE STOPS & LOCKS**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

**CAGERS, AUTOMATIC**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

Roberts & Schaefer Co., Chicago, Ill.

**CAGERS, AUTOMATIC & MANUAL**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

**CAGES**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

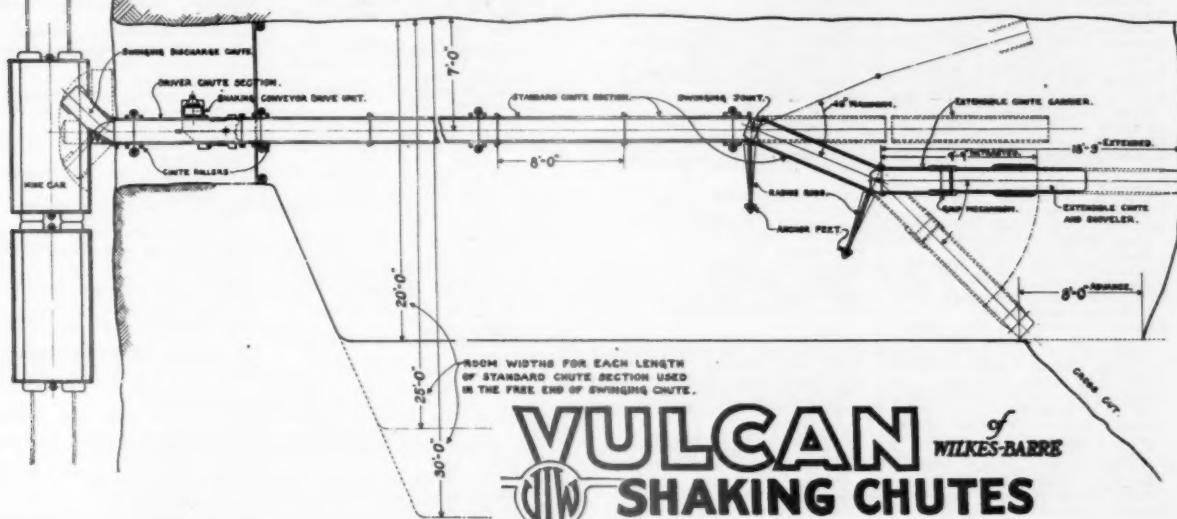
## SHAKING CHUTE CONVEYOR WITH SWINGING EXTENSIBLE SHOVELER AND SWINGING DISCHARGE CHUTE.

The method of gathering, conveying and loading materials with the shaking conveyor has proven to be the cheapest and most satisfactory. They are adaptable to any system of mining, and

will show decided operating economies, principally by reducing the amount of manual labor.

The initial cost and maintenance of the shaking type conveyor is considerably lower compared with conveyors of the chain or belt type, and has many advantages. The low height, the ease of extending or shortening the conveyor, the large capacity, easier supervision, eliminating track laying, low weight and simple construction of the drive are some of the advantages and savings that are achieved by the Vulcan shaking conveyor.

VULCAN IRON WORKS WILKES-BARRE, PA.



## For crosscuts and drifts - - -



many operators have decided that the use of HOAR SHOVELS provides a satisfactory solution of mucking problems.

\*\*\*

Write us for full details regarding the application of HOAR SHOVELS to your work.

\*\*\*

**ALLIS-CHALMERS MANUFACTURING COMPANY**  
MILWAUKEE, WISCONSIN. U.S.A.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

CARS (Self-dumping)

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

CALCINERS

Vulcan Iron Works, Wilkes-Barre, Pa.

CALCIUM CARBIDE

Union Carbide Sales Co., 30 East 42nd St., New York City.

CARBON AND BOKIZ

Diamond Drill Carbon Co., World Bldg., New York.

R. B. Patrick, Sellwood Building, Duluth, Minn.

CARBON FOR DIAMOND DRILLING

Diamond Drill Carbon Co., World Bldg., New York.

R. S. Patrick, Sellwood Building, Duluth, Minn.

Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.

CARBON BURNING APPARATUS

Oxweid Acetylene Co., 30 E. 42nd St., New York City.

CARBON ELECTRODES (for Electric Furnaces and Electrolytic Work)

National Carbon Co., Inc., Electrode Sales Division, 30 East 42nd St., New York City.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CARBONS (for Arc Lamps, Blue Printing, Photographic)

National Carbon Co., Inc., Cleveland, Ohio and San Francisco, Calif.

CARBON RODS AND PASTE FOR WELDING

Oxweid Acetylene Co., 30 E. 42nd St., New York City.

National Carbon Co., Inc., Cleveland, Ohio and San Francisco, Calif.

CARBON SPECIALTIES (Circuit Breaker Contacts, Packing Rings, Filter Plates, Tubes, etc.)

National Carbon Co., Inc., Cleveland, Ohio and San Francisco, Calif.

CAR DUMPERS, GRAVITY & POWER

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

Roberts & Schaefer Co., Chicago, Ill.

CAR DUMPERS (Rotary)

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

Roberts & Schaefer Co., Chicago, Ill.

CAR FEEDERS

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

CAR HAULS

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Hockenmith Wheel & Mine Car Co., Penna., Pa.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

CAR HAULERS

Johnson Wrecking Frog Co., Cleve- land, Ohio.

CAR RERAILERS

Johnson Wrecking Frog Co., Cleve- land, Ohio.

CAR RETARDERS

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

CAR REPLACERS

Johnson Wrecking Frog Co., Cleve- land, Ohio.

CAR RERAILERS

Johnson Wrecking Frog Co., Cleve- land, Ohio.

CAR RETARDERS

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

CARS, Coal

S. C. Card Iron Works Co., 16th & Alcott Sts., Denver, Colo.

## CARS, Metal Mine

U. S. Card Iron Works Co., 16th & Alcott Sts., Denver, Colo.

## CARS OF ALL DESCRIPTION

American Car & Foundry Co., 30 Church St., New York City.

Hockenmith Wheel & Mine Car Co., Penna., Pa.

## CAR STOPS, AUTOMATIC & MANUAL

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

Roberts & Schaefer Co., Chicago, Ill.

## CAR WIRE & CABLES

American Steel & Wire Co., Chi- cago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

## CLIPS, WIRE ROPE

American Steel & Wire Co., Chi- cago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

## CLOTH, WIRE

Ludlow Saylor Wire Co., St. Louis, Mo.

## CLUTCHES

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Timken Roller Bearing Co., Canton, Ohio.

## CASTINGS

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Vulcan Iron Works, Wilkes-Barre, Pa.

## CASTINGS, OPEN HEARTH STEEL

Vulcan Iron Works, Wilkes-Barre, Pa.

## CASTINGS (steel, iron)

Vulcan Iron Works, Wilkes-Barre, Pa.

## CAST STEEL FROGS

Central Frog & Switch Co., Cincinnati, Ohio.

## CHAINS

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## CHAINS, AUTOMOBILE ENGINE

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## CHAINS, COAL CUTTING

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## CHAINS, DRIVE

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## CHAINS, FRONT END

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## CHAIN LUBRICANTS

Standard Oil Co. (Ind.), Chicago, Ill.

## CHAIRS, OILING

Morse Chain Co., Ithaca, N. Y.

## CHAINS, POWER TRANSMISSION

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## CHAIRS, SILENT (Bushing-Pin Joint)

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

## CHAIRS, SLING

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## CHAIRS, SPROCKET WHEEL

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Joy Manufacturing Co., Franklin, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

## COAL CRUSHERS & ROLLS

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## COAL CUTTERS

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

## COAL HANDLING MACHINERY

American Coal Cleaning Corp., Welch, W. Va.

Conveyor Sales Co., 299 Broadway

New York City.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

## COAL LOADERS

Conveyor Sales Co., 299 Broadway

New York City.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway

New York City.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL MINING MACHINERY

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway

New York City.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL MINING PLANTS

American Coal Cleaning Corp., Welch, W. Va.

Conveyor Sales Co., 299 Broadway

New York City.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL PULLERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

American Coal Cleaning Corp., Welch, W. Va.

Conveyor Sales Co., 299 Broadway

New York City.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL RAILERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

American Coal Cleaning Corp., Welch, W. Va.

Conveyor Sales Co., 299 Broadway

New York City.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL STOPS, AUTOMATIC & MANUAL

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL TRAILERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

American Coal Cleaning Corp., Welch, W. Va.

Conveyor Sales Co., 299 Broadway

New York City.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL WIRE ROPE

American Steel & Wire Co., Chi- cago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

## COAL WIRE ROPE

American Steel & Wire Co., Chi- cago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

## CLOTH, WIRE

Ludlow Saylor Wire Co., St. Louis, Mo.

## CLUTCHES

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

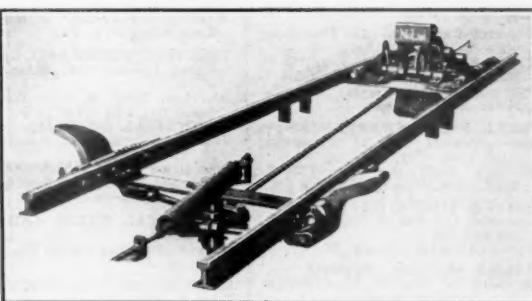
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

## COAL PREPARATION MACHINERY

American Coal Cleaning Corp., Welch, W. Va.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.</p



The new Nolan Bumper Stop Feeder in use at various mines throughout the coal districts. Stop shown in holding position.

## NOLAN

The new method of handling cars under all conditions. Catches bumpers. Folds down to permit passage of car or motor.

*Write for particulars*

**The MINING  
SAFETY DEVICE Co.**

BOWERSTON, OHIO



## There Are Many Grades of Wire Rope

*but it's the Right Grade  
for the Job that Counts!*

**Solve the wire rope problem  
by using**

## AMERICAN WIRE ROPE

(ON THE YELLOW REEL)

**American Steel & Wire Company**

CHICAGO - NEW YORK

Offices in all principal cities

*Largest manufacturers of wire rope in the world*

*What a prominent engineer says  
about  
ENTERPRISE WHEELS*

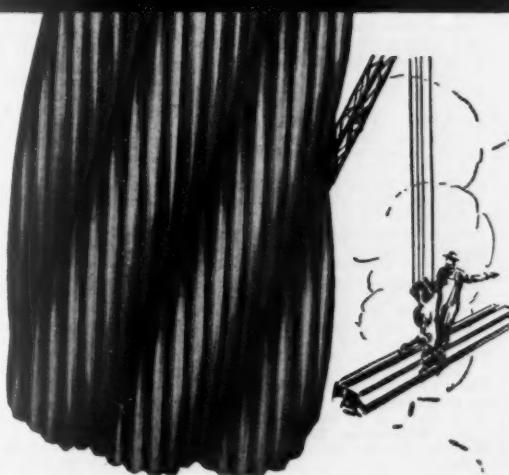
A retired railroad executive, who has been connected with a coal-carrying railroad for more than a quarter of a century, recently made this statement

"Down in Bristol, Virginia-Tennessee, there is a company that is producing the best car wheels made in America. They have connected with them a metallurgist of National fame, who seems to have solved the problem of producing a casting that is practically indestructible."

This well known engineer has reference to the famous ENTERPRISE WHEELS. The same may be truly said of the ENTERPRISE TRUCK and MINE CARS. If you want a disinterested opinion of the dependability and lasting qualities of a mine car, write us and we will give you the name of this engineer.



**ENTERPRISE**  
WHEEL & CAR CORPORATION  
BRISTOL, VA.-TENN. HUNTINGTON, W. VA.



**CONVEYORS, PAN OR APRON**

American Coal Cleaning Corp.,  
Welch, W. Va.  
The Jeffrey Mfg. Company, 958-99  
North 4th St., Columbus, Ohio.  
Link-Belt Co., 300 W. Pershing Rd.,  
Chicago, Ill.

**CONVEYORS, SCREW**

American Coal Cleaning Corp.,  
Welch, W. Va.  
The Jeffrey Mfg. Company, 958-99  
North 4th St., Columbus, Ohio.  
Link-Belt Co., 300 W. Pershing Rd.,  
Chicago, Ill.

**COOLERS, MAN**

Robinson Ventilating Co., Zelien-  
ople, Pa.

**COOLERS, ROTARY**

Vulcan Iron Works, Wilkes-Barre,  
Pa.

**COPPER WIRE & STRAND**

(Bare)  
American Steel & Wire Co., Chi-  
cago, Ill., and New York.  
John A. Roebling's Sons Co., Trent-  
on, N. J.

**CORE DRILLS, Carbon (Dia-  
monds) for**

R. S. Patrick, Sellwood Building,  
Duluth, Minn.

**CORE DRILLING**

Hoffman Bros. Drilling Co., Punxsutawney, Pa.

Pennsylvania Drilling Co., Pitts-  
burgh, Pa.

**COUPLINGS, FLEXIBLE**

Link-Belt Co., 300 W. Pershing Rd.,  
Chicago, Ill.

Westinghouse Electric & Mfg. Co.,  
East Pittsburgh, Pa.

**CROSSINGS AND CROSSOVERS**

Central Frog & Switch Co., Cincin-  
nati, Ohio.

West Virginia Rail Co., Hunting-  
ton, W. Va.

**CROSSOVERS**

Central Frog & Switch Co., Cincin-  
nati, Ohio.

Sweet's Steel Co., Williamsport, Pa.

**CRUSHER OILS**

Standard Oil Co. (Ind.), Chicago,  
Ill.

**CRUSHERS**

Allis-Chalmers Mfg. Co., Milwau-  
kee, Wis.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd.,  
Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre,  
Pa.

**CRUSHERS, SINGLE &**

DOUBLE ROLL

Allis-Chalmers Mfg. Co., Milwau-  
kee, Wis.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd.,  
Chicago, Ill.

**CRUSHING PLANTS, COKE**

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd.,  
Chicago, Ill.

**CRYSTAL (Quartz)**

Diamond Drill Carbon Co., World  
Bldg., New York.

**CUP GREASE**

Keystone Lubricating Co., Phila-  
delphia, Pa.

Standard Oil Co. (Ind.), Chicago,  
Ill.

**CUTTING APPARATUS, Oxy-**

Acetylene, Oxy-Hydrogen

Oxweld Acetylene Co., 30 E. 42d

St., New York City.

**CYCLONE DUST COLLECTORS**

American Coal Cleaning Corp.,

Welch, W. Va.

**DECARBONIZING APPARATUS**

Oxweld Acetylene Co., 30 E. 42d

St., New York City.

**DESIGNERS OF PLANTS**

American Coal Cleaning Corp.,

Welch, W. Va.

American Rheolaver Corporation,

Wilkes-Barre, Pa.

Link-Belt Co., 300 W. Pershing Rd.,  
Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

**DETONATORS**

E. I. Du Pont de Nemours & Co.,

Inc., Wilmington, Del.

Hercules Powder Co., Wilmington,  
Del.

**DIAMOND CORE DRILL**

Contracting  
Hoffman Bros. Drilling Co., Punxsutawney, Pa.

Sullivan Machinery Co., 122 S.

Mich. Ave., Chicago, Ill.

**DIAMOND DRILLING CARBON**

Diamond Drill Carbon Co., World  
Bldg., New York.

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DIAMONDS, BLACK (See Carbon  
and Borts)**

Diamond Drill Carbon Co., World  
Bldg., New York.

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DIAMONDS, INDUSTRIAL**

Diamond Drill Carbon Co., World  
Bldg., New York.

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DIAMOND TOOLS**

Diamond Drill Carbon Co., World  
Bldg., New York.

**DIESEL ENGINE OILS**

Standard Oil Co. (Ind.), Chicago,  
Ill.

**DIGGERS & PICKS, PNEUMATIC**

Ingersoll-Rand Co., 11 Broadway,

New York City.

**DOORS, AUTOMATIC MINE**

American Mine Door Co., Canton,

Ohio.

**DRIFTERS, DRILL**

Ingersoll-Rand Co., 11 Broadway,

New York City.

Sullivan Machinery Co., 122 S.

Mich. Ave., Chicago, Ill.

**DRILLERS' DIAMONDS**

Diamond Drill Carbon Co., World  
Bldg., New York.

**DRILLING CONTRACTORS**

Pennsylvania Drilling Co., Pitts-  
burgh, Pa.

Sullivan Machinery Co., 122 S.

Mich. Ave., Chicago, Ill.

**DRILLING, DIAMONDS FOR**

Diamond Drill Carbon Co., World  
Bldg., New York.

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DRILLS, AIR AND STEAM**

Ingersoll-Rand Co., 11 Broadway,

New York City.

**DRILLS (Blast Hole)**

Ingersoll-Rand Co., 11 Broadway,

New York City.

Keyes Churn Drill Co., Beaver

Falls, Pa.

**DRILL BITS, CARBON (Diamonds)**

for

Diamond Drill Carbon Co., World  
Bldg., New York.

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DRILL, CARBON (Diamonds) for**

Diamond Drill Carbon Co., World  
Bldg., New York.

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DRILL, CARBON (Diamonds) for**

Diamond Drill Carbon Co., World  
Bldg., New York.

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DRILL COLUMNS & MOUNT-  
INGS**

Ingersoll-Rand Co., 11 Broadway,

New York City.

Sullivan Machinery Co., 122 S.

Mich. Ave., Chicago, Ill.

**DRILL LUBRICANTS**

Standard Oil Co. (Ind.), Chicago,

Ill.

**DRILLER'S DIAMONDS**

R. S. Patrick, Sellwood Building,

Duluth, Minn.

**DRILLS, CORE**

Hoffman Bros. Drilling Co., Punxsutawney, Pa.

Ingersoll-Rand Co., 11 Broadway,

New York City.

**DRILLS, ELECTRIC**

General Electric Co., Schenectady,

N. Y.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Westinghouse Electric & Mfg. Co.,

East Pittsburgh, Pa.

## Capital for Mining Undertakings

Industrial or Public Utility Companies wishing to raise additional funds of from £50,000 to £500,000 for developments and extensions by means of Bond or Share Issues

are invited to communicate with

BYRNE & LANE  
14 Lower Leeson St.,  
Dublin, Ireland

**UNDERWRITING AND ISSUING OF CAPITAL for  
Approved Industrial and Mining Undertakings**

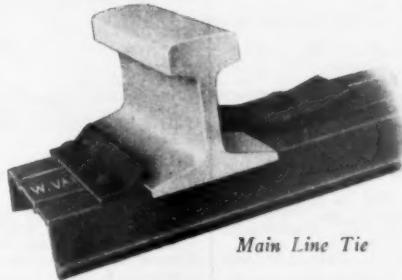
ESTABLISHED 1897

The facilities at the firm's disposal for handling Bond Issues with the minimum of expense enable it to purchase such issues upon terms which are very favorable to the borrowing undertakings.

**SPECIAL OFFER**

Quoted and Unquoted Shares placed on the European Market. We issue not less than 2,000 copies of prospectus to our investing clients each week, and include offerings which we approve of. A four-page prospectus (4 to size) will cost \$80 (eighty dollars), inclusive of all charges. Write for full particulars.

## Ties That Hold



Main Line Tie

### WEST VIRGINIA complete line of steel mine ties

The small "A1" tie for 8 to 20-lb. rail, the "B1" or the "B2" tie for 20 to 40-lb. rail, or the "T6" tie (as shown above) for 40 to 70-lb. rail, all hold the rails firmly in place. They are low in ultimate cost and are designed to meet all needs.

Send for data and quotations on all  
West Virginia Track Work



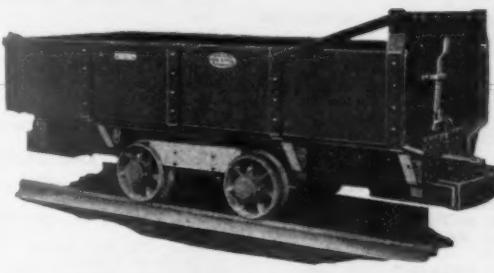
## Points of intersection—

switches, frogs, crossings, crossovers—these are crucial points of track systems. Even more important is the mine layout. We are proud of the engineering service and the efficient equipment we offer to the industry.

Send for catalog

THE CENTRAL FROG & SWITCH CO.  
CINCINNATI, OHIO

## CENTRAL MINE TRACK EQUIPMENT



## PHILLIPS MINE AND MILL SUPPLY COMPANY

Pittsburgh, Pa.



Phillips Steel Cars are fabricated over  
duplicating machines, and interchange-  
ability of replacing parts can always  
be depended upon. Phillips parts fit  
Phillips cars!



Write for Prices

**FEEDERS**

Hockenamith Wheel &amp; Mine Car Co., Penn, Pa.

**FEEDERS (Crossover, Kickback, Retary and Dumper)**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Phillips Mine &amp; Mill Supply Co., Pittsburgh, Pa.

Roberts &amp; Schaefer Co., Chicago, Ill.

**FEEDERS (Gravity)**

American Coal Cleaning Corp., Welsh, W. Va.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**FEEDERS (Hand Operated)**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Roberts &amp; Schaefer Co., Chicago, Ill.

**FEEDERS, ORE**

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**FEEDERS (Reciprocating)**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

American Coal Cleaning Corp., Welsh, W. Va.

**FEEDERS (Semi-automatic)**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Phillips Mine &amp; Mill Supply Co., Pittsburgh, Pa.

**FENCE POSTS**

Sweet's Steel Co., Williamsport, Pa.

**FIBRE GREASES**

Standard Oil Co. (Ind.), Chicago, Ill.

**FILTER CLOTH, WIRE**

Ludlow Saylor Wire Co., St. Louis, Mo.

**FILTERS (Dust)**

American Coal Cleaning Corp., Welsh, W. Va.

**FIRE AND WEATHER-PROOF WIRE**

John A. Roebling's Sons Co., Trenton, N. J.

**FLASHLIGHTS AND BATTERIES (Mine Safety)**

National Carbon Co., Inc., 30 East 42d Street, New York City.

**FLOORING, OPEN STEEL**

Hendrick Mfg. Co., Carbondale, Pa.

**FLOTATION MACHINES**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**FLOTATION OILS**

Hercules Powder Co., 934 King St., Wilmington, Del.

**FLOW METERS**

General Electric Co., Schenectady, N. Y.

**FLUX, WELDING**

Oxweld Acetylene Co., 30 E. 42d St., New York City.

**FORGINGS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**FROGS**

Central Frog &amp; Switch Co., Cincinnati, Ohio.

Sweet's Steel Co., Williamsport, Pa.

**FROGS AND SWITCHES**

Central Frog &amp; Switch Co., Cincinnati, Ohio.

West Virginia Rail Co., Huntington, W. Va.

**FURNACE OIL**

Standard Oil Co. (Ind.), Chicago, Ill.

**FURNACES, ROASTING**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Westinghouse Electric &amp; Mfg. Co., East Pittsburgh, Pa.

**GAS (Cutting, Welding)**

Frest-O-Lite Co., Inc., 30 E. 42d St., New York City.

**GAS (Nitrogen, Oxygen)**

Linde Air Products Co., 30 E. 42d St., New York City.

**GASOLINE**

Standard Oil Co. (Ind.), Chicago, Ill.

**GAS ENGINE OILS**

Standard Oil Co. (Ind.), Chicago, Ill.

**GAUGES, WELDING & CUTTING**

Central Frog &amp; Switch Co., Cincinnati, Ohio.

**GAUGE RODS**

Central Frog &amp; Switch Co., Cincinnati, Ohio.

**GAUGES, WELDING & CUTTING**

Oxweld Acetylene Co., 30 E. 42d St., New York City.

**GEAR COMPOUNDS**

Standard Oil Co. (Ind.), Chicago, Ill.

**GEARS**

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**GEARS, BEVEL**

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**GEARS (Fabroll & Textelite)**

General Electric Co., Schenectady, N. Y.

**GEARS, HERRINGBONE**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

**GEARS, MACHINE CUT**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

**GEARS, Moulded Teeth**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

**GEARS, SILENT CHAIN**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

**GEARS, SPUR**

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

**GEARS, WORM**

The Jeffrey Mfg. Company, 958-99

North 4th St., Columbus, Ohio.

**GELATIN DYNAMITES**

E. I. Du Pont de Nemours &amp; Co., Inc., Wilmington, Del.

Hercules Powder Co., Wilmington, Del.

**GENERATORS AND GENERATING SETS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**GLOVES, ASBESTOS**

Oxweld Acetylene Co., 30 E. 42d St., New York City.

**GOGGLES, WELDING**

Oxweld Acetylene Co., 30 E. 42d St., New York City.

**GRAPHITE GREASES**

Standard Oil Co. (Ind.), Chicago, Ill.

**GRATING, AREA, SIDE WALK**

Hendrick Mfg. Co., Carbondale, Pa.

**GREASE**

Keystone Lubricating Co., Philadelphia, Pa.

**GENERATORS, ACETYLENE**

Oxweld Acetylene Co., 30 E. 42d St., New York City.

**GRINDERS, PORTABLE**

Ingersoll-Rand Co., 11 Broadway, New York City.

**GUARD RAIL CLAMPS**

Central Frog &amp; Switch Co., Cincinnati, Ohio.

**GUY ROPE, GALVANIZED**

American Steel &amp; Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**HAMMERS, CALKING, CHIPPING & Riveting**

Ingersoll-Rand Co., 11 Broadway, New York City.

**HANGERS**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**HANGERS, INSULATED TRELLEY**

Ohio Brass Co., Mansfield, Ohio.

**HANGERS, BALL BEARING**

S K F Industries, New York City.

**HANGERS, SHAFT, DROP**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**HANGERS, SHAFT, POST**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**HANGERS, SHAFT, SELF-OILING**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**HARPOON**

S K F Industries, New York City.

**HAULAGE ROPE**

American Steel &amp; Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**HEADLIGHTS, ARC AND INCANDESCENT**

General Electric Co., Schenectady, N. Y.

**HEADLIGHTS, ELECTRIC**

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

**HEADLIGHTS, INCANDESCENT**

The Jeffrey Mfg. Company, 958-99

**HEADLIGHTS, INCANDESCENT**

North 4th St., Columbus, Ohio.

**HEADLIGHTS, INCANDESCENT**

Ohio Brass Co., Columbus, Ohio.

**HEADLIGHTS, INCANDESCENT**

Westinghouse Electric &amp; Mfg. Co., East Pittsburgh, Pa.

**HEADLIGHTS, INCANDESCENT**

East Pittsburgh, Pa.

**HEADLIGHTS, INCANDESCENT**

Ohio Brass Co., Mansfield, Ohio.

**HEADLIGHTS, INCANDESCENT**

Westinghouse Electric &amp; Mfg. Co., East Pittsburgh, Pa.

**HEADLIGHTS, INCANDESCENT**

General Electric Co., Schenectady, N. Y.

**HEADLIGHTS, INCANDESCENT**

John A. Roebling Sons Co., Trenton, N. J.

**HEADLIGHTS, INCANDESCENT**

Vulcan Iron Works, Wilkes-Barre, Pa.

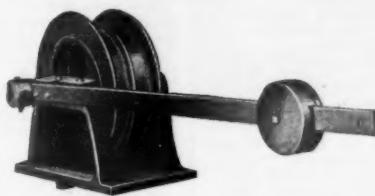
**HEADLIGHTS, INCANDESCENT**

Wilkes-Barre, Pa.

**HEADLIGHTS, INCANDESCENT**</div

## WEBSTER CAR RETARDERS

*Save Lives, Time and Money*



One man controls the movement of the cars—inch by inch if necessary—eliminating breakage and assuring well loaded cars without spillage. The car trimmer controls the car from a position of safety, safe from the dangers of runaway cars, faulty brakes, slippery tracks, etc.

*Easy to Install*

*Send for Car Retarder Circular*

*We Design and Make  
Complete Tipple Equipment*

**The Webster Mfg. Company**  
1856 N Kostner Ave. CHICAGO, ILL.

*Sole Manufacturers of  
Oldroyd Coal Cutters and Loaders*

## PATRICK CARBON

*for Diamond Core Drilling*

*"Specify Patrick Carbon"*

THIS organization of Specialists serves carbon users of practically every country in the world.

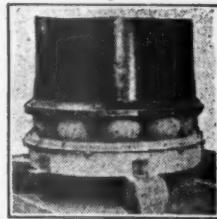
No matter how exacting your quality demands may be—we can satisfy them, completely.

SEND FOR BOOKLET

You can get in touch with our representative by wiring Duluth office

**R. S. PATRICK**  
Duluth, Minnesota, U.S.A.

Cable Address, Exploring Duluth



### ELLIS BALL-CHILI MILLS

Giant Mill—equal to 100 Stamps.  
18,000 lbs.; 25-H.P. \$5000.  
Little Giant Mill—35 Stamps.  
9400 lbs.; 10-H.P. \$2500.  
C-I Mill—10 Stamps.  
3300 lbs., \$995.  
B-I Mill—5 Stamps.  
1650 lbs., \$550.  
Independence Mill—5 ton.  
450 lbs.;  $\frac{1}{2}$ -H.P., \$285.  
Full Plant—  
2-H.P. engine, 4x6 Rockbreaker,  
feeder, etc.  
\$635

OVER 300 ELLIS MILLS IN USE

**ELLIS MILLS MFG. CO.**

MAIL ADDRESS: SHOW ROOM:  
147 Prospect Ave. SAN FRANCISCO, CALIF. 565 Bryant St.

### The Fan designed for the Job

ROBINSON'S 40 years of experience  
backed by an able organization of  
engineers and workmen develop the  
exact fan for the job and guarantee it  
accordingly.

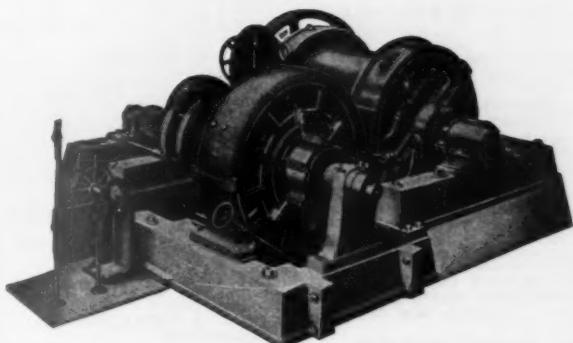
**ROBINSON**  
VENTILATING COMPANY

Pittsburgh, Pa.

FACTORY, ZELIENOPLE, PA.

### The Connellsville Manufacturing and Mine Supply Company

Connellsville, Pa.



If you need any cost reducing  
mine equipment, write us

**The Cage, Hoist and Fan Builder**

**LOADERS, Gravel and Sand**  
Joy Manufacturing Co., Franklin, Pa.  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**LOADERS (Mine Car)**  
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.  
The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.  
Joy Manufacturing Co., Franklin, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.  
Myers-Whaley Co., Knoxville, Tenn.

**LOADERS, PORTABLE**  
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.  
The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Joy Manufacturing Co., Franklin, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Myers-Whaley Co., Knoxville, Tenn.

**LOADERS, Snow**  
Joy Manufacturing Co., Franklin, Pa.

**LOADERS, Truck**  
Joy Manufacturing Co., Franklin, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**LOADERS, Wagon**  
Joy Manufacturing Co., Franklin, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**LOADING BOOMS**  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

**LOADING MACHINES**  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

Conveyor Sales Co., 299 Broadway, New York City.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Myers-Whaley Co., Knoxville, Tenn.

**LOCOMOTIVES, ELECTRIC**  
General Electric Co., Schenectady, N. Y.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**LOCOMOTIVES, GASOLINE**  
Vulcan Iron Works, Wilkes-Barre, Pa.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**LOCOMOTIVES, RACK RAIL**  
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

**LOCOMOTIVES, STEAM**  
Vulcan Iron Works, Wilkes-Barre, Pa.

**LOCOMOTIVES, STORAGE BATTERY**  
General Electric Co., Schenectady, N. Y.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Vulcan Iron Works, Wilkes-Barre, Pa.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**LOCOMOTIVE SWITCHING & WRECKING ROFES**

John A. Roebling's Sons Co., Trenton, N. J.

**LOCOMOTIVES (Third Rail)**  
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

**LOCOMOTIVES, TROLLEY**  
General Electric Co., Schenectady, N. Y.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**LONGWALL MACHINES**

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.

**LUBRICANTS**  
Keystone Lubricating Co., Philadelphia, Pa.  
Standard Oil Co. (Ind.), Chicago, Ill.

**LUBRICATORS**  
Keystone Lubricating Co., Philadelphia, Pa.

**MACHINE OILS**  
Standard Oil Co. (Ind.), Chicago, Ill.

**MACHINERY, TRANSMISSION (Power)**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

**MANIFOLDS, OXYGEN**

Oxweld Acetylene Co., 30 E. 42d St., New York City.

**MAST ARM ROPE, GALVANIZED**

John A. Roebling's Sons Co., Trenton, N. J.

**MILL GREASES**

Standard Oil Co. (Ind.), Chicago, Ill.

**MILLS, ROD & BALL**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**MILLS, STAMPS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**MINE CAR AXLES**

American Car & Foundry Co., 30 Church St., New York City.

Hockensmith Wheel & Mine Car Co., Penn, Pa.

**MINE CAR BEARINGS**

Hyatt Roller Bearing Co., Newark, N. J.

Timken Roller Bearing Co., Canton, Ohio.

**MINE CAR BOXES**

American Car & Foundry Co., 30 Church St., New York City.

Hockensmith Wheel & Mine Car Co., Penn, Pa.

**MINE CAR FORGINGS**

American Car & Foundry Co., 30 Church St., New York City.

Hockensmith Wheel & Mine Car Co., Penn, Pa.

**MINE CAR LUBRICANTS**

Keystone Lubricating Co., Philadelphia, Pa.

Standard Oil Co. (Ind.), Chicago, Ill.

**MINE CAR PARTS**

American Car & Foundry Co., 30 Church St., New York City.

Hockensmith Wheel & Mine Car Co., Penn, Pa.

**MINE CAR FORGINGS**

American Car & Foundry Co., 30 Church St., New York City.

Hockensmith Wheel & Mine Car Co., Penn, Pa.

**MINE CAR ROLLER BEARINGS**

American Car & Foundry Co., 30 Church St., New York City.

**MINE CARS**

American Car & Foundry Co., 30 Church St., New York City.

Enterprise Wheel & Car Corporation, Huntington, W. Va.

Hockensmith Wheel & Mine Car Co., Penn, Pa.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

**MINE CAR WHEELS**

American Car & Foundry Co., 30 Church St., New York City.

Hockensmith Wheel & Mine Car Co., Penn, Pa.

**MINE DOORS, AUTOMATIC**

American Mine Door Co., Canton, Ohio.

**MINE LOCOMOTIVE CABLE**

American Steel & Wire Co., Chicago, Ill., and New York.

General Electric Co., Schenectady, N. Y.

John A. Roebling's Sons Co., Trenton, N. J.

**MINE TIRES**

Central Frog & Switch Co., Cincinnati, Ohio.

**MINING & METALLURGICAL MACHINERY**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 955-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**MINING EQUIPMENT**</

**JOHNSON  
CAR REPLACERS**



Straddle the rail, require no fastening, bring rails to gauge during replacement keeping all weight on the rail. Made of open hearth cast steel, properly annealed. Write for particulars of different sizes.

**The Johnson Wrecking Frog Co.**  
1012 ULMER BLDG. CLEVELAND, OHIO

**AYER & LORD TIE Co.**  
INCORPORATED 1891  
CHICAGO

Railroad  
Cross Ties  
Lumber  
Poles

Bridge Timbers  
Car Stocks  
Filing  
Posts

TREATING PLANTS  
Carbondale, Ill. Grenada, Wis. North Little Rock, Ark.  
Louisville, Ky. Montgomery, Ala.

**"From the Tree  
To the Job"**



**CARD**  
DENVER

Specialists in the manufacture of coal and metal mine cars, wheels and trucks, rollers and sheaves, tipple equipment, and track equipment. Thirty-six years experience with western mining conditions. Write C. S. Card Iron Works Co., 16th and Alcott Streets, Denver, Colorado, for Catalog "J".



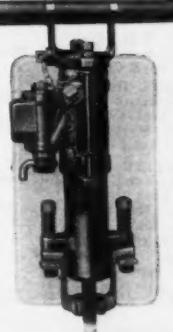
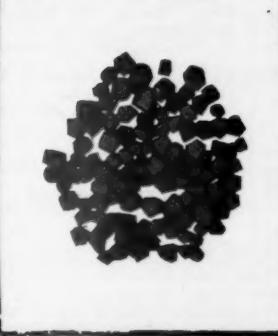
**Another SULLIVAN ROTATOR  
—the "L-8"**

For general rock drilling in your mine, try Sullivan "L-8" 39 lb. Rotators. Their lightness, freedom from vibration, drilling speed and air economy will surprise you.

Built in solid or hollow piston, or water-tube models, "L-8" will drill to 14 feet for 1 1/4-inch powder. It cuts fast in hard rock, yet cleans the hole effectively in soft or broken ground. "L-8" has an added advantage where air economy is important.

Ask for new Bulletin 3781-T.

Sullivan Machinery Company  
148 S. Michigan Ave., Chicago

**THE DIAMOND DRILL  
CARBON CO.**  
Direct Importers  
of  
**CARBONS**  **BORTZ**  
**BALLAS**  
**67 PARK ROW**  
New York - N.Y.

**DIRECT  
IMPORTERS**  
**CARBON (Black Diamonds) FOR DIAMOND CORE DRILLS.**  
**BORTZ (Industrial Diamonds)**  
**BRAZILIAN QUARTZ CRYSTAL**

**Phelps Dodge Corporation**  
99 JOHN STREET - - - - - NEW YORK

MEMBER COPPER & BRASS RESEARCH ASSOCIATION

**Copper**

"C \* Q"  
Electrolytic

"P. D. Co."  
Casting

**Irvington Smelting and  
Refining Works**

Buyers, Smelters and Refiners of  
Gold, Silver, Lead, Copper and Platinum  
Ores, Sweeps and Bullion

Manufacturers of Copper Sulphate

IRVINGTON :: NEW JERSEY

NEW YORK OFFICE—Charles Engelhard  
Hudson Terminal Building 80 Church Street

**PUMPS (Gathering or Dip)**  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

**PUMPS, Inclined Shaft**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**PUMPS, MINE**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.  
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

**PUMPS, Slaking**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**PUMPS, PNEUMATIC AIR LIFT**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**PUMPS, POWER**  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.  
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

**PUMPS, SAND**  
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

**PUMPS, STEAM**  
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

**PUMPS, VACUUM**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**PUNCHES, Drill Steel**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.**

**QUARRYING MACHINERY**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.**

**QUARTZ CRYSTAL**  
Diamond Drill Carbon Co., World Bldg., New York.

**RADIO ACTIVE ORE**  
O. Barlow Willmarth, Georgetown, Colo.

**RADIUM ORE**  
O. Barlow Willmarth, Georgetown, Colo.

**RAIL BONDS**  
American Steel & Wire Co., Chicago, Ill., and New York.  
General Electric Co., Schenectady, N. Y.

**Ohio Brass Co., Mansfield, Ohio.**  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**RAIL BRACES**  
Central Frog & Switch Co., Cincinnati, Ohio.

**RAILWAY SUPPLIES**  
General Electric Co., Schenectady, N. Y.

**Ohio Brass Co., Mansfield, Ohio.**  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**RAMMERS, Pneumatic**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**RECEIVERS, AIR**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**REGULATORS, Welding and Cutting, Compressed Gas**  
Oxweil Acetylene Co., 30 E. 42d St., New York City.

**REHEATERS, Air**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**REINFORCING BARS**  
Sweet's Steel Co., Williamsport, Pa.  
West Virginia Rail Co., Huntington, W. Va.

**RESCUE APPARATUS**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**RETARDERS**  
Mining Safety Device Co., Bowers- ton, Ohio.  
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

**RIVER CROSSING SUSPENSION WIRE, Galvanized**  
John A. Roebling's Sons Co., Trenton, N. J.

**ROCK-DISPOSAL EQUIPMENT**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**ROCK DRILLS**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**ROCK DUSTING EQUIPMENT**  
American Mine Door Co., Canton, Ohio.

**RODS, WELDING**  
Ohio Brass Co., Mansfield, Ohio.  
Oxweil Acetylene Co., 30 E. 42d St., New York City.

**ROLLER BEARINGS**  
Enterprise Wheel & Car Corporation, Huntington, W. Va.  
Hyatt Roller Bearing Co., Newark, N. J.

**Timken Roller Bearing Co., Canton, Ohio.**

**ROLLERS**  
C. S. Card Iron Works Co., 16th & Alcott Sts., Denver, Colo.

**ROLLS (Crushing)**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**ROPE**  
American Steel & Wire Co., Chicago, Ill., and New York.

**ROPE, TRANSMISSION**  
American Steel & Wire Co., Chicago, Ill., and New York.  
John A. Roebling's Sons Co., Trenton, N. J.

**ROPE, WIRE**  
American Steel & Wire Co., Chicago, Ill., and New York.  
John A. Roebling's Sons Co., Trenton, N. J.

**ROTARY DRYERS**  
Vulcan Iron Works, Wilkes-Barre, Pa.

**ROTARY COOLERS**  
Vulcan Iron Works, Wilkes-Barre, Pa.

**ROTARY DUMPS**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Mining Safety Device Co., Bowers- ton, Ohio.**  
Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

**Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.**

**ROTARY ROASTERS**  
Vulcan Iron Works, Wilkes-Barre, Pa.

**ROTARY STRANDS, GALVANIZED**  
John A. Roebling's Sons Co., Trenton, N. J.

**SHARPENERS, DRILL**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.**

**SHREWS**  
C. S. Card Iron Works Co., 16th & Alcott Sts., Denver, Colo.

**Hockensmith Wheel & Mine Car Co., Penn, Pa.**

**John A. Roebling's Sons Co., Trenton, N. J.**

**SAFETY APPLIANCES, MINE**  
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

**SAFETY FUSE**  
Hercules Powder Co., Wilmington, Del.

**SAFETY FUSE & WIRES—LEADING & CONNECTING**  
E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del.

**SAND DRYERS**  
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

**SASH CORDS**  
John A. Roebling's Sons Co., Trenton, N. J.

**SAWS (Air)**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**SCRAPER LOADERS**  
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

**Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.**

**SCREEN BARS**  
Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

**SCREENS (Anti-Gravity)**  
American Coal Cleaning Corps., Welch, W. Va.

**SCREENS, ARCH-CRIMP**  
Ludlow Saylor Wire Co., St. Louis, Mo.

**SCREENS, DOUBLE CRIMPED**  
Ludlow Saylor Wire Co., St. Louis, Mo.

**SCREENS, HORIZONTAL**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.**

**SCREENS, REEK-TANG**  
Ludlow Saylor Wire Co., St. Louis, Mo.

**SCREENS, REVOLVING**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Hendrick Mfg. Co., Carbondale, Pa.**  
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**ROLLER BEARINGS**  
Enterprise Wheel & Car Corporation, Huntington, W. Va.

**Hyatt Roller Bearing Co., Newark, N. J.**

**Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.**

**ROPE, SHEETING**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.**

**Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHEETS**  
American Rheolaveur Corporation, Wilkes-Barre, Pa.

**Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**ROPE, SHREWS**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

**Welch, W. Va.**

**SOCKETS, Open and Closed**  
John A. Roebling's Sons Co., Trenton, N. J.

**SPECIAL MACHINERY**  
Vulcan Iron Works, Wilkes-Barre, Pa.

**SPEED REDUCERS, DOUBLE**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Morse Chain Co., Ithaca, N. Y.**

**SPEED REDUCERS, SINGLE**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Morse Chain Co., Ithaca, N. Y.**

**SPIKES**  
Sweet's Steel Co., Williamsport, Pa.  
West Virginia Rail Co., Hunting- ton, W. Va.

**SPICE BARS (Plain and Angle)**  
Carnegie Steel Co., Pittsburgh, Pa.  
Central Frog & Switch Co., Cincinnati, Ohio.

**SPICE, CABLE**  
American Mine Door Co., Canton, Ohio.

**SPICE, INSULATOR**  
American Mine Door Co., Canton, Ohio.

**SPICE, TROLLEY WIRE**  
General Electric Co., Schenectady, N. Y.

**Ohio Brass Co., Mansfield, Ohio.**

**SPICERS, TROLLEY**  
American Mine Door Co., Canton, Ohio.

**Ohio Brass Co., Mansfield, Ohio.**

**WESTINGHOUSE ELECTRIC & MFG. CO.,**  
East Pittsburgh, Pa.

**SPROCKETS, CLAMP HUB**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Morse Chain Co., Ithaca, N. Y.**

**SPROCKETS, COMPENSATING**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Morse Chain Co., Ithaca, N. Y.**

**SPROCKETS (Shearing Pin)**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Morse Chain Co., Ithaca, N. Y.**

**SPROCKETS, SILENT CHAIN**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Morse Chain Co., Ithaca, N. Y.**

**SPROCKETS, SPRING**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**Morse Chain Co., Ithaca, N. Y.**

**SPUR GEAR DRIVES**  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**STARTER CABLES**  
John A. Roebling's Sons Co., Trenton, N. J.

**STEAM CYLINDER OILS**  
Standard Oil Co. (Ind.), Chicago, Ill.

**STEEL, ALLOY**  
Timken Roller Bearing Co., Canton, Ohio.

**STEEL, CROSS TIES**  
Carnegie Steel Co., Pittsburgh, Pa.  
Sweet's Steel Co., Williamsport, Pa.  
West Virginia Rail Co., Hunting- ton, W. Va.

**STEEL, ELECTRIC FURNACE**  
Timken Roller Bearing Co., Canton, Ohio.

**STEEL, HOLLOW AND SOLID DRILL**  
Ingersoll-Rand Co., 11 Broadway, New York City.

**STEEL, NICKEL**  
Timken Roller Bearing Co., Canton, Ohio.

**STEEL, NICKEL, MOLYBDENUM**  
Timken Roller Bearing Co., Canton, Ohio.

**STEEL, OPEN HEARTH**  
Timken Roller Bearing Co., Canton, Ohio.

**STEEL, REINFORCING**  
American Mine Door Co., Canton, Ohio.

**STEEL, SHAPES, PLATES, BARS, ETC.**  
Carnegie Steel Co., Pittsburgh, Pa.

**STEEL, SPECIAL ANALYSIS**  
Timken Roller Bearing Co., Canton, Ohio.

# THORNE, NEALE & COMPANY, Inc.

FRANKLIN BANK BUILDING  
1416 CHESTNUT STREET—9 A. M. to 4 P. M.  
PHILADELPHIA, PA.

MINERS' AGENTS AND WHOLESALE DEALERS

*Anthracite*      **COAL**      *Bituminous*

ANTHRACITE COLLIERIES

Mt. Lookout  
Serrick Creek

Harry E  
Northwest

Forty Fort  
Lackawanna

New Castle  
Buck Run

Locust Run  
(Washery)

Pardee Bros. & Co. — Lattimer Lehigh

BITUMINOUS

Sonman, South Fork District—Low volatile, low ash, low sulphur

Smithing—1 1-4 in. screened

Fairmont — Quemahoning — Indiana County

NEW YORK OFFICE: 17 BATTERY PLACE

Branch Offices: Baltimore

Buffalo

Chicago

Scranton, Pa.

Mauch Chunk, Pa.



Stock and Special Signs, Codes, Etc., for Mines

## RADIUM ORE

High and Low Grade Carnotite containing  
Uranium and Vanadium.

O. BARLOW WILLMARTH

Montrose, Colo., U. S. A.

ORVIS C. HOFFMAN, Pres.

LEON H. HOFFMAN, Treas.

HOFFMAN-BROS-DRILLING-CO.

PUNXSUTAWNEY, PA.

DIAMOND CORE DRILLING

CONTRACTORS

PROSPECTING FOR ANY MINERAL. MORE THAN 20  
YEARS EXPERIENCE. SATISFACTION GUARANTEED.

### We Look Into the Earth

By using Diamond Core Drills.  
We prospect Coal and Mineral  
Lands in any part of North or  
South America.

Pennsylvania Drilling Co.  
Pittsburgh, Pa.  
Drilling Contractors



## 5 articles on MECHANIZATION

and what it means to industry in this issue. Follow the developments of the nation-wide survey of mechanization as reports appear in later issues of this Journal.

**STEEL TIES AND REINFORCEMENTS**

Carnegie Steel Co., Pittsburgh, Pa.  
West Virginia Rail Co., Huntington, W. Va.

**STEPS, SAFETY STAIR AND LADDER**

Hendrick Mfg. Co., Carbondale, Pa.  
**STOPERS, ROCK DRILL**  
Ingersoll-Rand Co., 11 Broadway, New York City.

Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.

**STORAGE BATTERY LOCOMOTIVES**

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.  
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.  
Vulcan Iron Works, Wilkes-Barre, Pa.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**STRAND**

American Steel & Wire Co., Chicago, Ill., and New York.  
John A. Roebling's Sons Co., Trenton, N. J.

**SWITCHBOARD WIRE AND CABLES**

American Steel & Wire Co., Chicago, Ill., and New York.  
John A. Roebling's Sons Co., Trenton, N. J.  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**SWITCHBOARDS, POWER**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**SWITCHES**

Central Frog & Switch Co., Cincinnati, Ohio.  
Sweet's Steel Co., Williamsport, Pa.

**SWITCHES, ALTERNATING**

Mining Safety Device Co., Bowers- ton, Ohio.

**SWITCHES (Disconnecting and Electric)**

General Electric Co., Schenectady, N. Y.  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**SWITCHES AND FROGS,**

**TROLLEY**  
American Mine Door Co., Canton, Ohio.  
Central Frog & Switch Co., Cincinnati, Ohio.  
Ohio Brass Co., Mansfield, Ohio.  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**TACKLE BLOCKS**

John A. Roebling's Sons Co., Trenton, N. J.

**TANKS**

Hendrick Mfg. Co., Carbondale, Pa.

**TELEGRAPH AND TELEPHONE WIRES AND CABLES**

American Steel & Wire Co., Chicago, Ill., and New York.  
John A. Roebling's Sons Co., Trenton, N. J.

**TELEPHONE CORDS**

American Steel & Wire Co., Chicago, Ill., and New York.  
John A. Roebling's Sons Co., Trenton, N. J.

**THIMBLES**

American Steel & Wire Co., Chicago, Ill., and New York.  
John A. Roebling's Sons Co., Trenton, N. J.

**TIES (Steel, Mine)**

Carnegie Steel Co., Pittsburgh, Pa.  
Central Frog & Switch Co., Cincinnati, Ohio.

**TIES, WOOD TREATED**

Curtin-Howe Corp., 11 Park Place, New York City.

**TILLER ROPE**

John A. Roebling's Sons Co., Trenton, N. J.

**TIMBER PRESERVING EQUIPMENT**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Curtin-Howe Corp., 11 Park Place, New York City.

**TIMBERS, STEEL MINE**

Carnegie Steel Co., Pittsburgh, Pa.

**TIMBERS, WOOD TREATED**

Curtin-Howe Corp., 11 Park Place, New York City.

**TIPPLES**

American Coal Cleaning Corp., Welch, W. Va.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.  
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

**TIPLLE EQUIPMENT**

American Coal Cleaning Corp., Welch, W. Va.  
C. S. Card Iron Works Co., 16th & Alcott Sts., Denver, Colo.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.  
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.  
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

**TIPLLE TRACK**

Central Frog & Switch Co., Cincinnati, Ohio.

**TIRE WIRES**

John A. Roebling's Sons Co., Trenton, N. J.

**TOOLS, BLACKSMITHS (for drill steel)**

Ingersoll-Rand Co., 11 Broadway, New York City.

**TORCHES**, BRAZING, CARBON BURNING, CUTTING, LEAD BURNING, WELDING, WELDING AND CUTTING  
Oxweld Acetylene Co., 30 E. 42nd St., New York City

**TRACK BOLTS**

Sweet's Steel Co., Williamsport, Pa.

**TRACK EQUIPMENT**

Carnegie Steel Co., Pittsburgh, Pa.  
Central Frog & Switch Co., Cincinnati, Ohio.

Sweet's Steel Co., Williamsport, Pa.  
West Virginia Rail Co., Huntington, W. Va.

**TRACK LAYOUTS (Industrial)**

Central Frog & Switch Co., Cincinnati, Ohio.

Sweet's Steel Co., Williamsport, Pa.

**TRACKS, PORTABLE, RAIL, ETC.**  
Carnegie Steel Co., Pittsburgh, Pa.  
Central Frog & Switch Co., Cincinnati, Ohio.

West Virginia Rail Co., Huntington, W. Va.

**TRACK (Portable)**

Carnegie Steel Co., Pittsburgh, Pa.  
Central Frog & Switch Co., Cincinnati, Ohio.

Sweet's Steel Co., Williamsport, Pa.

**TRACK (Portable, Assembled and Unassembled, Riveted or Bolted)**  
Carnegie Steel Co., Pittsburgh, Pa.  
Central Frog & Switch Co., Cincinnati, Ohio.

West Virginia Rail Co., Huntington, W. Va.

**TRACK BRACES**

Central Frog & Switch Co., Cincinnati, Ohio.

**TRACK EQUIPMENT**

C. S. Card Iron Works Co., 16th & Alcott Sts., Denver, Colo.

**TRACK SUPPLIES**

Carnegie Steel Co., Pittsburgh, Pa.  
Central Frog & Switch Co., Cincinnati, Ohio.

West Virginia Rail Co., Huntington, W. Va.

**TRAMWAYS, AERIAL**

American Steel & Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**TRANSFORMERS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**TRANSMISSION**

S F K Industries, 40 E. 34th St., New York City.

**TRANSMISSION OILS AND GREASES**

Standard Oil Co. (Ind.), Chicago, Ill.

**TRANSMISSION, SILENT CHAIN**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

**TREADS, SAFETY STAIR AND LADDER**

Hendrick Mfg. Co., Carbondale, Pa.

**TROLLEY FROGS**

Ohio Brass Co., Mansfield, Ohio.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**TIPPLES**

American Coal Cleaning Corp., Welch, W. Va.

**TROLLEY (Hangers and Clamps)**  
General Electric Co., Schenectady, N. Y.

Ohio Brass Co., Mansfield, Ohio.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**TROLLEY MATERIAL, OVER-HEAD**

Ohio Brass Co., Mansfield, Ohio.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**TROLLEY WHEELS AND HARPS**

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Mining Safety Device Co., Bowers- ton, Ohio.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**TROLLEY WIRE**

American Steel & Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**TRUCKS**

C. S. Card Iron Works Co., 16th & Alcott Sts., Denver, Colo.

**TRUCKS, WELDER'S**

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

**TURBINE BLOWERS**

Robinson Ventilating Co., Zelienople, Pa.

**TURBINES, HYDRAULIC**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Standard Oil Co. (Ind.), Chicago, Ill.

**TURBINES, STEAM**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**TURBONIC BLOWERS**

American Steel & Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**TURNOUTS**

Sweet's Steel Co., Williamsport, Pa.

**VALVES**

Ohio Brass Co., Mansfield, Ohio.

**VALVES, BACK PRESSURE, PRESSURE REDUCING**

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

**VANADIUM ORE**

O. Barlow Willmarth, Georgetown, Ohio.

**VENTILATING EQUIPMENT**

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Robinson Ventilating Co., Zelienople, Pa.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**VISES, RIGGERS**

John A. Roebling's Sons Co., Trenton, N. J.

**WAGON LOADERS**

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**WASHERS**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

American Coal Cleaning Corp., Welch, W. Va.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

**WEIGH BASKETS**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

**WEIGH HOPPERS**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

**WELDING CARBONS (for Electric Arc and Gas Welding Operations)**

National Carbon Co., Inc., Cleveland, Ohio and San Francisco, Calif.

**WELDING and CUTTING APPARATUS, ETC. (Oxy-Acetylene)**

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

**WELDING APPARATUS, ELECTRIC ARC**

Ohio Brass Co., Mansfield, Ohio.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**WELDING and CUTTING APPARATUS, ETC. (Oxy-Acetylene)**

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

**WELDING WIRE, ELECTRIC**

American Steel & Wire Co., Chicago, Ill., and New York.

Ohio Brass Co., Mansfield, Ohio.

John A. Roebling's Sons Co., Trenton, N. J.

**WELDING WIRE, GAS**

American Steel & Wire Co., Chicago, Ill., and New York.

Ohio Brass Co., Mansfield, Ohio.

John A. Roebling's Sons Co., Trenton, N. J.

**WELDING WIRE, WATER AND GAS**

Pennsylvania Drilling Co., Pittsburgh, Pa.

**WHEELS, CAST IRON**

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

**WHEELS, STEEL, MINE CAR & LOCOMOTIVES**

Carnegie Steel Co., Pittsburgh, Pa.

**WIRE AND CABLE**

American Steel & Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**WIRE CLOTH**

Ludlow Saylor Wire Co., St. Louis, Mo.

**WIRE LEADING & CONNECTING**

Hercules Powder Co., Wilmington, Del.

**WIRE ROPE**

American Steel & Wire Co., Chicago, Ill., and New York.

**WIRE ROPE, SPECIAL AND STANDARD**

John A. Roebling's Sons Co., Trenton, N. J.

**WIRE ROPE DRESSINGS**

Standard Oil Co. (Ind.), Chicago, Ill.

**WIRE ROPE FITTINGS**

American Steel & Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**WIRE ROPE SLINGS**

American Steel & Wire Co., Chicago, Ill., and New York.

John A. Roebling's Sons Co., Trenton, N. J.

**WIRE, WELDING**

American Steel & Wire Co., Chicago, Ill., and New York.

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

John A. Roebling's Sons Co., Trenton, N. J.

**WOOD BORING MACHINES, PNEUMATIC**

Ingersoll-Rand Co., 11 Broadway, New York City.

**WOOD PRESERVATIVES**

Curtin-Howe Corp., 11 Park Place, New York City.

**WOOL GREASE**

Keystone Lubricating Co., Philadelphia, Pa.

Standard Oil Co. (Ind.), Chicago, Ill.

**WOVEN WIRE SCREENS**

Ludlow Saylor Wire Co., St. Louis, Mo.

**WRECKING FROGS**

Johnson Wrecking Frog Co., Cleveland, Ohio.

**WRENCHES, ALLIGATOR**

John A. Roebling's Sons Co., Trenton, N. J.

**YARN GREASES**

Standard Oil Co. (Ind.), Chicago, Ill.

# American Mining Congress

## OFFICERS AND COMMITTEES, 1929

### OFFICERS

Robert E. Tally, *President*  
 Wm. H. Lindsey, *First Vice President*  
 Jesse F. McDonald, *Second Vice President*  
 S. Livingston Mather, *Third Vice President*  
 J. F. Calbraith, *Secretary*

### DIVISION STAFF

George H. Bailey, *Counsel*  
 M. W. Krieger, *Tax Division*  
 Dr. Henry Mace Payne, *Consulting Engineer*  
 E. R. Coombes, *Assistant to Secretary*  
 J. M. Hadley, *Standardization Division*  
 G. B. Southward, *Mechanization Engineer*  
 J. R. Hurlburt, *Field Representative*  
 E. H. Pulman, *Bulletin Service*

### DIRECTORS

Archibald Douglas, New York, N. Y.  
 L. S. Cates, Salt Lake City, Utah  
 Stanly A. Easton, Kellogg, Idaho  
 Wm. H. Lindsey, Nashville, Tenn.  
 Robert E. Tally, Clarkdale, Ariz.  
 J. G. Bradley, Dundon, W. Va.  
 Hugh Shirkie, Terre Haute, Ind.  
 James T. Skelly, Wilmington, Del.  
 J. F. Robinson, Miami, Okla.  
 Jesse F. McDonald, Leadville, Colo.  
 S. L. Mather, Cleveland, Ohio  
 Otis Mouser, Philadelphia, Pa.  
 J. B. Warriner, Lansford, Pa.

### EXECUTIVE COMMITTEE

Robert E. Tally J. B. Warriner  
 Otis Mouser

### SOUTHERN DIVISION

#### Chairman

Dr. A. V. Henry, Georgia School of Technology, Atlanta, Ga.

#### Secretary

Dr. Henry Mace Payne, 841 Munsey Bldg., Washington, D. C.

#### Members

R. G. Brown, Louisville, Miss.  
 M. J. Caples, 628 Fairfax Ave., Norfolk, Va.  
 Judge J. H. Hand, Yelville, Ark.  
 Dr. A. V. Henry, Georgia School of Technology, Atlanta, Ga.  
 E. L. Hertzog, Spartanburg, S. C.  
 H. M. Madison, Southern Pacific R. R., Houston, Tex.  
 C. J. Neckamp, Northeast Kentucky Coal Association, Ashland, Ky.  
 Leaday Ogen, Florida Travertine Corp., Bradenton, Fla.  
 Major Wade H. Phillips, Department of Conservation, Raleigh, N. C.  
 Erskine Ramsay, Alabama By-Products Co., American Traders National Bank Bldg., Birmingham, Ala.  
 Colonel W. H. Sullivan, Bogalusa, La.  
 H. I. Young, Mascot, Tenn.

### WESTERN DIVISION

#### BOARD OF GOVERNORS

Frank M. Smith, Spokane, Wash., *Chairman of the Division*  
 Leon Starmont, Spokane, Wash., *Secretary of the Division*  
 Arizona—Harry A. Clark, Douglas, Ariz.; W. B. Goering, 419 Heard Bldg., Phoenix, Ariz.  
 California—Philip Wiseman, 1206 Pacific Mutual Bldg., Los Angeles; G. Chester Brown, Chunie Bldg., San Francisco, Calif.  
 Colorado—C. L. Berrien, Drawer 1375, Butte; W. B. Daly, 510 Hennessey Bldg., Butte.  
 Nevada—J. C. Kinnean, McGill; Henry M. Rives, Nevada Mine Operas Assn., Reno.  
 New Mexico—J. M. Sully, Chino Copper Co., Hurley; J. F. Woodbury, N. M. Chapter, American Mining Congress, Silver City.  
 Oregon—Robert M. Betts, Cornucopia; A. W. Strowger, Northwestern Bank Bldg., Portland.  
 South Dakota—R. G. Wayland, Homestake Mining Co., Lead; B. C. Yates, Homestake Mining Co., Lead.  
 Utah—Oscar Friendly, 1003 Continental Bank Bldg., Salt Lake City; A. G. Mackenzie, Kerna Bldg., Salt Lake City.  
 Washington—Frank M. Smith, Paulson Bldg., Spokane; Leon Starmont, 312 Lindelle Block, Spokane.

### MANUFACTURERS DIVISION

#### OFFICERS

##### Honorary Chairmen

N. S. Greensfelder, Hercules Powder Co., Wilmington, Del.  
 J. C. Wilson, Ohio Brass Co., Mansfield, Ohio  
 H. K. Porter, Hyatt Roller Bearing Co., Harrison, N. J.

##### Chairman

H. A. Buzby, Keystone Lubricating Co., Philadelphia, Pa.

##### Vice Chairman

C. L. Herbster, Hockensmith Wheel & Mine Car Co., Penn, Pa.  
 F. J. Maple, John A. Roebling's Sons Co., Trenton, N. J.  
 Chas. C. Whaley, Myers-Whaley Co., Knoxville, Tenn.

##### Members

American Car & Foundry Co., 30 Church St., New York City, H. C. Wick.

Atlas Powder Co., Wilmington, Del., G. S. Scott, Automatic Reclosing Circuit Breaker Co., Columbus, Ohio, C. M. Hickle.

Bethlehem Steel Co., Bethlehem, Pa., S. H. Yorks, Brown-Fayco Co., Johnstown, Pa., Carnegie Steel Co., Pittsburgh, Pa., R. L. Twitchell.

Central Frog & Switch Co., Cincinnati, Ohio, E. R. Heitzmann, Cutler-Hammer Mfg. Co., Milwaukee, Wis., F. U. Webster.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., E. F. Carley.

Edison Storage Battery Co., Orange, N. J., G. E. Stringfellow.

Electric Railway Equipment Co., Cincinnati, Ohio, A. L. Johnston.

Enterprise Wheel & Car Corp., Bristol, Va.-Tenn., C. P. Daniel.

Fairbanks, Morse & Co., Chicago, Ill., G. J. Podlesak.

General Electric Co., Schenectady, N. Y., L. W. Shugg.

Hendrick Mfg. Co., Carbondale, Pa., B. G. Sholton, Hercules Powder Co., Wilmington, Del., N. S. Greensfelder.

Hockensmith Wheel & Mine Car Co., Penn, Pa., C. L. Herbster.

Robt. Holmes & Bros., Inc., Danville, Ill., Grant Holmes, Pres.

Hyatt Roller Bearing Co., Harrison, N. J., H. K. Porter.

Jeffrey Mfg. Co., Columbus, Ohio, Robert Jeffrey, Keystone Consolidated Publishing Co., 10th Ave. at 36th St., New York City, Ralph C. Becker.

Keystone Lubricating Co., Philadelphia, Pa., H. A. Buzby.

A. Leschen & Sons Rope Co., St. Louis, Mo., L. H. Gault.

Link-Belt Co., Chicago, Ill., A. J. Sayers.

Ludlow-Saylor Wire Co., St. Louis, Mo., Duncan Meier.

Mancha Storage Battery Locomotive Co., St. Louis, Mo., Raymond Mancha.

Mine Safety Appliances Co., Pittsburgh, J. T. Ryan.

Mining Engineering Co., Ltd., 715 Continental Bldg., Baltimore, Md., Clarence A. Claghorn, Myers-Whaley Co., Knoxville, Tenn., Wm. A. Whaley.

Morse Chain Co., Ithaca, N. Y., C. L. Saunders.

National Carbon Co., Inc., P. O. Box 400, Cleveland, Ohio, E. A. Williford.

Ohio Brass Co., Mansfield, Ohio, J. C. Wilson.

Phillips Mine & Mill Supply Co., Pittsburgh, Pa., J. Milton Duff.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill., Col. W. R. Roberts.

John A. Roebling's Sons Co., Trenton, N. J., F. J. Maple.

Simplex Wire & Cable Co., Chicago, Ill., A. Hagen, S. K. F. Industries, Inc., 40 E. 34th St., New York City, R. C. Byler.

Southern Wheel Co., St. Louis, Mo., F. C. Turner, Vice Pres., 1300 Keystone Bldg., Pittsburgh, Pa.

Streeter-Amet Weighing & Recording Co., Chicago, Ill., H. F. Reck.

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill., S. B. King.

Timken Roller Bearing Co., Canton, Ohio, E. R. Phillips.

W. S. Tyler Co., Cleveland, Ohio, G. R. Delamater, Watt Car & Wheel Co., Barnesville, Ohio, H. H. Watt.

Weir Kilby Corp., Cincinnati, Ohio, J. K. Lansdowne.

Watt-Wilhouse Electric & Mfg. Co., E. Pittsburgh, Pa., F. H. Grunnagle.

### TAX DIVISION

#### GENERAL TAX COMMITTEE

Paul Armitage, *Chairman*  
 233 Broadway, New York, N. Y.  
 Geo. E. Holmes, *Vice-Chairman*  
 15 William St., New York, N. Y.

R. C. Allen, Hanna Building, Cleveland, Ohio.  
 A. Scott Thompson, Miami, Okla.  
 Wm. B. Gower, 20 Exchange Place, New York, N. Y.  
 J. C. Dick, 511 Newhouse Bldg., Salt Lake City.  
 A. P. Ramstedt, Wallace, Idaho.  
 E. L. Doheny, 120 Broadway, New York City.  
 Robt. N. Miller, Southern Bldg., Washington, D. C.  
 H. B. Fernald, 60 Broad St., New York City.  
 T. T. Brewster, Federal Res. Bank Bldg., St. Louis, Mo.  
 Wm. N. Davis, Bartlesville, Okla.

### STANDARDIZATION DIVISION

#### COAL MINING BRANCH

##### General Committee

Colonel Warren R. Roberts (*Chairman*), Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.  
 A. B. Kiser, Gen. Supt. of Elec. Equipment, Pittsburgh Coal Co., Pittsburgh, Pa.  
 R. E. Krape, Gen. Mgr., Timber Dept., Rochester & Pittsburgh Coal & Iron Co., Indiana, Pa.  
 Fred Norman, Chf. Engr., Allegheny River Mining Co., Kittanning, Pa.  
 F. L. Stone, Industrial Engr. Dept., General Electric Co., Schenectady, N. Y.  
 L. E. Young, Vice President, Pittsburgh Coal Co., Pittsburgh, Pa.

##### Mine Timbering—Coal

##### M. E. Haworth, *Chairman*

SUB-COMMITTEE NO. 1—GENERAL MINE TIMBERING, SIMPLIFICATION ON GRADES AND NAMES  
 D. F. Holtman (*Chairman*), Asst. Director, National Committee on Wood Utilization, Dept. of Commerce, Washington, D. C.  
 R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.  
 R. W. Austin, American Mond Nickel Co., North 3rd St., Clearfield, Pa.  
 J. R. Crowe, Jr., Pres., Crowe Coal Co., Dwight Bldg., Kansas City, Mo.  
 P. L. Dryer, Engr., Alabama Fuel & Iron Co., Pioneer Bldg., Birmingham, Ala.  
 G. A. Knox, Supt., Gunn-Qualey Coal Co., Gunn, Wyo.  
 Ernest M. Merrill, Consulting, Civil and Mining Engineer, Charleston, W. Va.  
 Davis Read, Chf. Engr., West Kentucky Coal Co., Sturgis, Ky.  
 George S. Rice, Chf. Mng. Engr., U. S. Bureau of Mines, Washington, D. C.  
 J. R. Sharp,  
 Geo. T. Stevens, Chf. Engr., Clinchfield Coal Corp., Dante, Va.  
 Frank A. Young, Chf. Engr., St. Louis, Rocky Mountain & Pacific Co., Raton, N. M.

SUB-COMMITTEE NO. 2—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (*Chairman*), In Charge of Wood Preservation Section, Forest Products Laboratory, Madison, Wis.  
 R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.  
 W. L. Affelder, Asst. to Pres., Hillman Coal & Coke Co., 2306 First Natl. Bank Bldg., Pittsburgh, Pa.  
 R. W. Austin, American Mond Nickel Co., North 3rd St., Clearfield, Pa.  
 M. E. Haworth, Chf. Engr., Hillman Coal & Coke Co., First Natl. Bank Bldg., Pittsburgh, Pa.  
 J. A. Nelson, Joyce-Watkins Co., Metropolis, Ill.  
 J. C. Quade, Chf. Engr., Saline County Coal Corp., Harrisburg, Ill.  
 M. H. Sellers, Timber Agent, Chicago, Wilmington & Franklin Coal Co., Carbondale, Ill.  
 D. A. Stout, Colorado Fuel & Iron Co., Pueblo, Colo.  
 H. E. Tuff, Grasselli Chemical Co., Cleveland, Ohio.

SUB-COMMITTEE NO. 3—USE OF CONCRETE IN MINE TIMBERING

Newell G. Alford (*Chairman*), Vice Pres., Howard N. Eavenson & Associates, 1300 Union Trust Bldg., Pittsburgh, Pa.  
 R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.

## OFFICERS AND COMMITTEES, 1929 (Continued)

Jas. R. Barber, Asst. Engr., St. Louis, Rocky Mountain & Pacific Co., Raton, N. Mex.  
D. W. Blaylock, Min. Engr., Madison Coal Corp., Glen Carbon, Ill.  
Walter Buss, Knox Consolidated Coal Co., Bicknell, Ind.

B. C. Collier, Pres., Cement-Gun Co., Inc., Allentown, Pa.  
W. E. Guller, Edwardsville, Ill.  
Frank Haas, care J. H. Weaver & Co., 260 So. Broad St., Philadelphia, Pa.

Daniel Harrington, U. S. Bureau of Mines, Washington, D. C.  
C. T. Haydock, Asst. Gen. Mgr., O'Gara Coal Co., McCormick Bldg., Chicago, Ill.

Fred J. Hogan, Mining Engineer, Spangler, Pa.  
L. W. Householder, Chf. Engr., Rochester & Pittsburgh Coal Co., Indiana, Pa.

W. R. Peck, Gen. Mgr., Black Diamond Collieries Co., Coal Creek, Tenn.

J. C. Quade, Chf. Engr., Saline County Coal Co., Harrisburg, Ill.

C. E. Swann, Chf. Engr., Union Pacific Coal Co., Rock Springs, Wyo.

S. Tescher, Gen. Supt., National Fuel Co., Colorado Bldg., Denver, Colo.

H. S. Wright, Engineer, Structural & Technical Bureau, Portland Cement Assn., 33 West Grand Ave., Chicago, Ill.

**SUB-COMMITTEE NO. 4—USE OF METAL FOR MINE TIMBERING**

L. B. Abbott, Chf. Engr., Consolidation Coal Co., Jenkins, Ky.

R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.

D. W. Blaylock, Mng. Engr., Madison Coal Corp., Glen Carbon, Ill.

J. M. Clark, Jr., E. E. White Coal Co., Mt. Hope, W. Va.

R. V. Clay, Wheeling & Lake Erie Coal Mining Co., Cleveland, Ohio.

A. W. Hesse, Chf. Coal Mng. Engr., Buckeye Coal Co., Nemacolin, Pa.

R. A. Marke, Carnegie Steel Co., 434 Fifth Ave., Pittsburgh, Pa.

Geo. A. Richardson, Bethlehem Steel Co., Bethlehem, Pa.

J. A. Saxe, Chf. Engr., Bethlehem M'nes Corp., Ellsworth, Pa.

Frank A. Young, Chf. Engr., St. Louis, Rocky Mountain & Pacific Co., Raton, N. Mex.

**SUB-COMMITTEE NO. 5—SALVAGE OF MINE TIMBER**

R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.

Frank S. Follansbee, Meadcroft Coal Co., Woodward, Ala.

H. F. McCullough, In charge of Mechanization of Mines, Consolidation Coal Co., Fairmont, W. Va.

George T. Stevens, Chf. Engr., Clinchfield Coal Corp., Dante, Va.

**SUB-COMMITTEE NO. 6—REFORESTATION**

C. R. Anderson, Professor of Forestry Extension, Pennsylvania State College, State College, Pa.

M. H. Doolittle, Supt., Carbondale Coal Co., Carbondale, Pa.

John W. Keller, Chf., State Forest Extension, Harrisburg, Pa.

Edmund Seest, State Forester, Wooster, Ohio.

A. C. Silvius, Forester, Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.

J. M. Sloan, Secretary-Treasurer, Anthracite Forest Protective Assn., 431 West Broad St., Hazleton, Pa.

Ralph A. Smith, Secretary-Treasurer, Pennsylvania Forest Products Manufacturing Assn., Tyrone, Pa.

D. A. Stout, Colorado Fuel & Iron Co., Pueblo, Colo.

R. D. Tonkin, Forester, Clearfield Bituminous Coal Corp., Indiana, Pa.

W. D. Tyler, V. P., Clinchfield Coal Corp., Dante, Va.

**Mine Drainage**

**SUB-COMMITTEE NO. 1—PUMPS FOR DEVELOPMENT WORK**

L. W. Householder (Chairman), Chf. Engr., Rochester & Pittsburgh Coal Co., Church St. & Carpenter Ave., Indiana, Pa.

E. F. Austin, Dravo-Doyle Co., Pittsburgh, Pa.

Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.

J. H. Edwards, Associate Editor, Coal Age, 2962 Winter Rd., Huntington, W. Va.

F. J. Emery, V. P., The Deming Co., Salem, Ohio.

J. E. Holweck, Dist. Mgr., Aldrich Pump Co., 1209 Empire Bldg., Pittsburgh, Pa.

G. E. Huttle, Mech. Engr., H. O. Frick Coke Co., Scottsdale, Pa.

H. J. Nelms, Gen. Supt., Crucible Fuel Co., Crucible, Pa.

F. W. Smith, Crawford Machinery Co., 219 Scotland St., Pittsburgh, Pa.

**SUB-COMMITTEE NO. 2—PERMANENT PUMPING STATIONS**

Parker Cott (Chairman), Salesman, Coal Mine Equipment Co., Farmers Bank Bldg., Pittsburgh, Pa.

Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.

Henry E. Cole, Pres., Harris Pump & Supply Co., 320 2nd Ave., Pittsburgh, Pa.

J. P. Heidenreich, Asst. Gen. Mgr., Scranton Pump Co., Scranton, Pa.

W. L. Robison, V. P., Youghiogheny & Ohio Coal Co., 1230 Hanna Bldg., Cleveland, Ohio.

R. F. Roth, Emmons Coal Mng. Co., Grant Town, W. Va.

Cecil W. Smith, care Minnesota Northern Power Co., 881 Second Ave., So., Minneapolis, Minn.

M. Spillman, Works Engr., Worthington Pump & Machinery Corp., Worthington Works, Harrison, N. J.

L. D. Tracy, Supt., U. S. Bureau of Mines, 4 Forbes Terrace, Pittsburgh, Pa.

**SUB-COMMITTEE NO. 3—NATURAL DRAINAGE**

John Brunschwyler (Chairman), Div. Supt., Boomer Coal & Coke Co., Boomer, W. Va.

Oscar Cartidge, Cons. Engr., 1593 Lee St., Charleston, W. Va.

L. P. Crecelius, Engr., Crecelius & Phillips, Engineers, 1517 Union Trust Bldg., Cleveland, Ohio.

E. D. Knight, 2207 Washington St., Charleston, W. Va.

R. Y. Wert, Supt., Durham Coal & Iron Co., Soddy, Tenn.

**SUB-COMMITTEE NO. 4—UNWATERING ABANDONED WORKINGS**

G. E. Huttle, Mech. Engr., H. C. Frick Coke Co., Scottsdale, Pa.

O. M. Pruitt, Pres., Indiana Air Pump Co., Indiana Pythian Bldg., Indianapolis, Ind.

Chas. A. Straw, Cons. Mech. Engr., Hudson Coal Co., 434 Wyoming Ave., Scranton, Pa.

G. V. Woody, Gen. Mgr., Allis-Chalmers Mfg. Co., Wilkes-Barre, Pa.

**SUB-COMMITTEE NO. 5—MINE WATER AND ITS ACTION UPON MINE DRAINAGE EQUIPMENT**

A. P. Cameron, Vice Pres., Westmoreland Coal Co., Irwin, Pa.

J. R. Campbell, American Rheolaveur Co., Scottsdale, Pa.

W. M. Corse, 910 18th St. N. W., Washington, D. C.

Parker Cott, Coal Mine Equipment Co., 2218 Farmers Bank Bldg., Pittsburgh, Pa.

J. H. Doughty, Mechanical Engineer, Lehigh and Wilkes-Barre Coal Co., Wilkes-Barre, Pa.

T. W. Gray, Pittsburgh Coal Co., Library, Pa.

C. L. Harrod, Elec. Engr., Indiana Coal Operators Assn., 1509 Merchants Bank Bldg., Indianapolis, Ind.

W. H. Hinks, Engr., Imperial Coal Corp., Johnstown, Pa.

R. E. Hobart, Mech. Supt., Lehigh Coal & Navigation Co., Lansford, Pa.

W. E. Housman, Research Engr., H. C. Frick Coke Co., Scottsdale, Pa.

Wm. L. Jacobus, Chemist, Susquehanna Collieries Co., Wilkes-Barre, Pa.

G. G. Kanable, Engineering Dept., Rochester and Pittsburgh Coal Co., Indiana, Pa.

R. L. Kingsland, Elec. Engr., Consolidation Coal Co., Fairmont, W. Va.

Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.

T. F. McCarthy, Asst. Genl. Supt., Clearfield Bituminous Coal Corp., Indiana, Pa.

J. A. Malady, E. E. & M. M., Hillman Coal & Coke Co., 1st Natl. Bk. Bldg., Pittsburgh, Pa.

J. D. Martin, Genl. Supt. of Coal Mines, Virginian Iron, Coal and Coke Co., Colonial Natl. Bk. Bldg., Roanoke, Va.

Frank G. Morris, Genl. Supt. of Mines, Republic Iron and Steel Co., Sayreton, Ala.

R. C. Newman, Chief Engineer, Wheeling and Lake Erie Coal Mining Co., 223 Grant St., Cadiz, Ohio.

J. M. Provost, Chief Engineer, Pittsburgh Terminal Coal Corp., Wabash Bldg., Pittsburgh, Pa.

L. D. Royer, Cons. Engr., Travis Bldg., San Antonio, Tex.

W. A. Selvig, Associate Chemist, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

W. E. Valentine, Genl. Supt., Cascade Coal and Coke Co., Sykesville, Pa.

M. E. Walther, Elec. and Mech. Engr., Pennsylvania Coal Co., P. O. Box 553, Scranton, Pa.

P. A. Witherpoon, Chief Engineer, Carnegie Coal Co., Oliver Bldg., Pittsburgh, Pa.

**Manufacturers Cooperating**

Allis-Chalmers Mfg. Co., Milwaukee, Wis. (W. M. White, Mgr. and Chf. Engr., Hydraulic Dept.)

Barrett, Haentjens & Co., Hazleton, Pa. (W. M. McKee, Inc., Pittsburgh representative, Oliver Bldg., Pittsburgh, Pa.)

Brown-Fayro Co., Johnstown, Pa. (H. V. Brown, Genl. Mgr.)

Dravo-Doyle Co., Dravo Bldg., Pittsburgh, Pa. (E. F. Austin, Secy.)

Duraloy Co., Pittsburgh, Pa. (C. P. Mills, Chf. Engr.)

Duriron Co., Inc., Dayton, Ohio. (W. E. Pratt, Fairstock, Morse & Co., Chicago, Ill. (Lloyd Yost, Mgr., Research Div.)

Goulds Pumps, Inc., Seneca Falls, N. Y. (A. L. McHugh, Chf. Engr.)

Indiana Air Pump Company, 816 Indiana Pythian Bldg., Indianapolis, Ind. (O. M. Pruitt, Pres.)

International Nickel Co., 67 Wall St., New York City. (W. M. Corse, 810 18th St. N. W., Washington, D. C.)

LaBour Company, Chicago Heights, Ill. (Merco Nordstrom Valve Co., Inc., 110 W. 40th St., New York City. (C. E. Brown.)

Ohio Steel Castings Co., 2284 Scranton Rd., Cleveland, Ohio. (F. E. Clark.)

Rumsey Pump Co., Ltd., Seneca Falls, N. Y. (R. R. Micks, Secy. and Treas.)

Westinghouse Elec. and Mfg. Co., E. Pitts-

burgh, Pa. (P. O. Box 781, Knoxville, Tenn.)

**Mining and Loading Equipment**

L. E. Young, Chairman

**SUB-COMMITTEE NO. 1—LOADERS**

T. E. Jenkins (Chairman), Vice Pres., West Kentucky Coal Co., Sturgis, Ky.

Newell G. Alford, Cons. Engr., Howard N. Eavenson & Associates, Union Trust Bldg., Pittsburgh, Pa.

I. N. Bayless, Gen. Supt., Utah Fuel Co., Castle Gate, Utah.

Edw. Bottomley, Sheridan Wyoming Coal Co., Sheridan, Wyo.

Frank E. Cash, U. S. Bureau of Mines, New Federal Bldg., Birmingham, Ala.

Walter M. Duke, Consulting Engineer, Joy Mfg. Co., Franklin, Pa.

J. L. Goss, Sales Mgr., Bertrand P. Tracy Co., Pittsburgh, Pa.

T. W. Gray, Asst. Supt. of Electric Equipment, Pittsburgh Coal Co., Library, Pa.

Arthur C. Green, Mgr., Central District, Goodman Mfg. Co., Halsted St. & 48th Pl., Chicago, Ill.

G. W. Hay, Gen. Mgr., Elk Horn Coal Corp., Inc., Wayland, Ky.

F. V. Hicks, Director of Mechanical Loading, Union Pacific Coal Co., Rock Springs, Wyo.

T. E. Jenkins, V. P., West Kentucky Coal Co., Sturgis, Ky.

N. D. Levin, Jeffrey Mfg. Co., Columbus, Ohio.

N. H. McClevey, Vice Pres. & Gen. Mgr., Pike County Coal Corp., Petersburg, Ind.

Norton A. Newdick, Vice Pres., The Coloder Co., Inc., Columbus, Ohio.

C. B. Officer, Chf. Engr., Sullivan Machinery Co., 122 So. Michigan Ave., Chicago, Ill.

C. S. Oldroyd, Pres., Oldroyd Machine Co., Cincinnati, Ohio.

Alex Palomis, Link-Belt Co., Philadelphia, Pa.

Geo. Schultz, Gen. Supt., Liberty Fuel Co., Latuda, Utah.

E. A. Siemon, Asst. Gen. Supt., Hillman Coal & Coke Co., 1st National Bank Bldg., Pittsburgh, Pa.

W. D. Turnbull, General Engineering Dept., Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

Wm. Whaley, Gen. Mgr., Myers-Whaley Co., P. O. Box 781, Knoxville, Tenn.

**SUB-COMMITTEE NO. 2—CONVEYORS**

A. P. Cameron (Chairman), Vice Pres., Westmoreland Coal Co., Irwin, Pa.

W. L. Affelder, Asst. to Pres., Hillman Coal & Coke Co., Pittsburgh, Pa.

John S. Beltz, Mining Engineering Dept., Jeffrey Mfg. Co., Columbus, Ohio.

Frank E. Cash, U. S. Bureau of Mines, New Federal Bldg., Birmingham, Ala.

T. W. Dawson, Chf. Engr., H. C. Frick Coke Co., Scottsdale, Pa.

A. W. Dickinson, Union Pacific Coal Co., Rock Springs, Wyo.

Thos. G. Fear, Gen. Mgr., Operations, Consolidation Coal Co., Fairmont, W. Va.

E. B. Gellatly, Gellatly & Co., H. W. Oliver Bldg., Pittsburgh, Pa.

Chas. Gottschalk, Buckskin, Ind.

Glen A. Knox, Supt., Gunn-Quealy Coal Co., Gunn, Wyo.

E. F. Miller, Gen. Supt., Bertha-Consumers Coal Co., Rachel, W. Va.

C. W. Nelson, Blue Diamond Coal Co., Westbourne, Tenn.

Edw. B. Raiguel, Chf. Engr., Coal Service Corp., 1st Natl. Bk. Bldg., Huntington, W. Va.

D. A. Stout, Colorado Fuel & Iron Co., Pueblo, Colo.

J. Charlton Truax, Sales Engr., Bertrand P. Tracy Co., Pittsburgh, Pa.

W. D. Turnbull, General Engineering Dept., Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

W. R. Youmans, Sales Mgr., Ironton Engine Co., Ironton, Ohio.

J. D. Zook, V. P. & Chf. Com., Ill. Coal Ops. Labor Assn., 1407 Fisher Bldg., Chicago, Ill.

**SUB-COMMITTEE NO. 3—METHODS OF MINING WITH MECHANICAL LOADING**

G. B. Southward (Chairman), Mechanization Engineer, American Mining Congress, Washington, D. C.

A. R. Anderson, Engr., Jeffrey Mfg. Co., Columbus, Ohio.

## OFFICERS AND COMMITTEES, 1929 (Continued)

D. J. Carroll, Woodward Iron Co., Woodward, Ala.  
 Frank E. Cash, U. S. Bureau of Mines, New Federal Bldg., Birmingham, Ala.  
 C. R. Claghorn, Consulting Mining Engineer, 715 Continental Trust Bldg., Baltimore, Md.  
 S. W. Farnham, Mng. Engr., Goodman Mfg. Co., Chicago, Ill.  
 E. H. Johnson, Safety Mining Co., 307 N. Michigan Ave., Chicago, Ill.  
 R. G. Lawry, Contracting Engr., Roberts & Schaefer Co., Chicago, Ill.  
 H. F. McCullough, In Charge of Mechanization, Consolidation Coal Co., Fairmont, W. Va.  
 E. S. McKinlay, Pres., McKinlay Mining & Loading Machine Co., Room 1817, Conway Bldg., Chicago, Ill.  
 Cecil W. Smith, care Minnesota Northern Power Co., 831 Second Ave., So. Minneapolis, Minn.  
 Walter Stevens, Supt., Raleigh-Wyoming Coal Co., Glen Rogers, W. Va.  
 F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Denver, Colo.  
 F. G. Wilcox, Pres., West End Coal Co., Mears Bldg., Scranton, Pa.  
 R. Y. Williams, Chf. Engr., Weston, Dodson & Co., Inc., Pottsville, Pa.

## SUB-COMMITTEE NO. 4—CUTTING MACHINES

Carl Scholz (Chairman), Vice Pres., Raleigh-Wyoming Mng. Co., Charleston, W. Va.  
 A. R. Anderson, Engineer, Jeffrey Mfg. Co., Columbus, Ohio.  
 Frank E. Cash, U. S. Bureau of Mines, New Federal Bldg., Birmingham, Ala.  
 J. M. Clark, V. P., Clark & Krebs, Inc., 204 Boyce Bldg., Charleston, W. Va.  
 John L. Connors, Pres., Morgan-Gardner Electric Co., Harvey, Ill.  
 Wm. E. Hamilton, Mgr., W. E. Hamilton Engineering Co., 310 Schultz Bldg., Columbus, Ohio.  
 A. W. Hesse, Chf. Coal Mng. Engr., Buckeye Coal Co., Nemacolin, Pa.  
 M. C. Mitchell, Mgr., Sullivan Machinery Co., Rwy. Exchange Bldg., St. Louis, Mo.

## Outside Coal Handling Equipment

J. W. Bischoff, Gen. Supt., West Virginia Coal & Coke Co., Omar, W. Va.  
 W. G. Duncan, Jr., Supt., W. G. Duncan Coal Co., Greenville, Ky.  
 Geo. Watkins Evans, Coal Mng. Engr., L. C. Smith Bldg., Seattle, Wash.  
 W. G. Henning, Secretary and Treasurer, A. Lechen & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.  
 M. A. Kendall, Chf. Engr., Stephens-Adamson Mfg. Co., Aurora, Ill.  
 Rudolf Kudlich, Asst. to Chf. Mech. Engr., U. S. Bureau of Mines, Washington, D. C.  
 John J. Moore, Dey & Maddock, 82d and Dennison Sta., Cleveland, Ohio.  
 F. G. Morris, Genl. Supt. of Coal Mines, Republic Iron & Steel Co., Sayerton, Ala.  
 G. H. Morse, Genl. Supt., Republic Iron & Steel Co., Oliver Bldg., Pittsburgh, Pa.  
 H. F. Nash, Mgr. of Sales, Rocky Mountain Fuel Co., 510 Temple Court Bldg., Denver, Colo.  
 Warren R. Roberts, Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.  
 H. D. Smith, Asst. to Pres., Majestic Collieries Co., Peery Bldg., Bluefield, W. Va.  
 C. R. Stahl, Asst. to Genl. Mgr., C. C. B. Smokeless Coal Co., Stotesbury, W. Va.  
 C. Law Watkins, Vice Pres., Pennsylvania Coal & Coke Corp., Cresson, Pa.  
 F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Ernest & Cranmer Bldg., Denver, Colo.

## Mine Ventilation

## A. W. Hesse, Chairman

C. E. Abbott, Gen. Mgr., Tennessee Coal, Iron & R. R. Co., Brown Mtn. Bldg., Birmingham, Ala.  
 W. D. Brennan, Gen. Mgr., Phelps Dodge Corp., Stag Canon Branch, Dawson, N. Mex.  
 A. P. Cameron, Vice Pres., Westmoreland Coal Co., Irwin, Pa.  
 Thomas Chester, Consulting Engineer, 1313 Corrada Road, Pittsburgh, Pa.  
 H. G. Conrad, Gen. Mgr., American Coal Mng. Co., Bicknell, Ind.  
 S. D. Dimick, Gen. Mgr., Glen Alden Coal Co., Scranton, Pa.  
 J. H. Doughty, Mech. Engr., Lehigh & Wilkes-Barre Coal Co., 16 So. River St., Wilkes-Barre, Pa.  
 R. M. Fleming, Ebensburg Coal Co., Colver, Pa.  
 D. Harrington, U. S. Bureau of Mines, Washington, D. C.  
 J. A. Helms, Gen. Supt., Fordson Coal Co., Stone, Ky.  
 Otto Herres, Asst. Mgr., U. S. Fuel Co., Box 1699, Salt Lake City, Utah.  
 R. L. Kingsland, E. E. P. & M. Dept., Consolidation Coal Co., Fairmont, W. Va.  
 John Land, Asst. Gen. Supt., Underground Operations, Old Ben Coal Corp., West Frankfort, Ill.  
 Martin J. Lide, Consulting Engineer, Woodward Bldg., Birmingham, Ala.

G. E. Lyman, Gen. Supt., Madison Coal Corp., Glen Carbon, Ill.  
 G. C. McFadden, Asst. V. P., Penbody Coal Co., 332 So. Michigan Ave., Chicago, Ill.  
 W. J. Montgomery, Jeffrey Mfg. Co., Columbus, Ohio.  
 R. H. Moore, Gen. Mgr., C. A. Hughes & Co., Portage, Pa.  
 George F. Oaler.  
 R. M. Perry, Gen. Supt., Moffat Coal Co., 504 Gas & Elec. Bldg., Denver, Colo.  
 J. R. Robinson, Pres., Robinson Ventilating Co., Pittsburgh, Pa.  
 W. A. Rose, Chf. Engr., American Blower Co., Detroit, Michigan.  
 M. C. Scheble, Gen. Supt., McAlester Fuel Co., McAlester, Okla.  
 W. C. Shunk, Gen. Mgr., Stonega Coke and Coal Co., Big Stone Gap, Va.  
 D. A. Stout, Colorado Fuel & Iron Co., Pueblo, Colo.  
 H. A. Treadwell, Chf. Operating Engr., Chicago, Wilmington & Franklin Coal Co., Benton, Ill.  
 E. B. Wagner, Lehigh Valley Coal Co., Wilkes-Barre, Pa.  
 Robert Wallace, Supt., Pocahontas Fuel Co., Inc., Pocahontas, Va.  
 Joe J. Walsh, Inspector, 8th District, 430 So. Franklin St., Wilkes-Barre, Pa.  
 L. E. Young, Vice Pres., Pittsburgh Coal Co., Pittsburgh, Pa.  
 J. D. Zook, V. P. & Chf. Com., Ill. Coal Oper. Labor Assn., 1407 Fisher Bldg., Chicago, Ill.

## Power Equipment

## F. L. Stone, Chairman

W. C. Adams, Allen & Garcia, Chicago, Ill.  
 Graham Bright, Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.  
 O. P. Hood, Chf. Technologic Branch, U. S. Bureau of Mines, Washington, D. C.  
 J. T. Jennings, Power Engr., Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.  
 R. L. Kingsland, Consolidation Coal Co., Fairmont, W. Va.  
 M. D. Kirk, Vesta Coal Co., Jones & Laughlin Bldg., Pittsburgh, Pa.  
 Chas. Legrand, Cons. Engr., Phelps Dodge Corp., Douglas, Ariz.  
 Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.  
 J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., 2307 First National Bank Bldg., Pittsburgh, Pa.  
 A. J. Nicht, Jr., Engr., Hoisting Equipment, Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 W. C. Shunk, Stonega Coal & Coke Co., Big Stone Gap, Va.  
 Geo. S. Thompson, Chf. Elec. & Master Mech., Colorado Fuel & Iron Co., Pueblo, Colo.  
 W. A. Wilson, Pacific Coast Coal Co., Seattle, Wash.  
 C. D. Woodward, Chf. Elec. Engr., Anaconda Copper Mining Co., 508 Hennessy Bldg., Butte, Mont.

## Underground Power Transmission

## A. B. Kiser, Chairman

W. A. Chandler, Elec. Engr., Hudson Coal Co., Scranton, Pa.  
 Harvey Conrad, Genl. Mgr., American Coal Mng. Co., Bicknell, Ind.  
 L. C. Haley, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.  
 R. L. Kingsland, Elec. Engr., Power and Mechanical Dept., Consolidation Coal Co., Fairmont, W. Va.  
 Carl Lee, Elec. Engr., Peabody Coal Co., 1652 McCormick Bldg., Chicago, Ill.  
 Wm. Schott, Cons. Engr., Big Creek Coal Co., Chicago, Ill.  
 Henry M. Warren, Cons. Engr., Glen Alden Coal Co., 300 Jefferson Ave., Scranton, Pa.

## Underground Transportation

## Fred Norman, Chairman

## MAIN COMMITTEE

Fred Norman (Chairman), Chf. Engr., Allegheny River Mining Co., Kittanning, Pa.  
 Frank S. Barks, Pres., Lincoln Steel and Forge Co., St. Louis, Mo.  
 Graham Bright, Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.  
 Joe. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.  
 Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.  
 T. F. Downing, Jr., Cons. Engr., 5320 Walnut St., Philadelphia, Pa.  
 A. H. Egle, V. P., Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.  
 W. J. Fene, Bureau of Mines, University of Utah, Salt Lake City, Utah.  
 Robert J. Forester, Supt., Paradise Coal Co., Du Quoin, Ill.  
 J. D. Forrester, Mgr., Teton Coal Co., Sam Teton Co., Idaho.

J. D. Martin, Genl. Supt. of Coal Mines, Virginia Iron, Coal & Coke Co., Colonial Natl. Bk. Bldg., Roanoke, Va.  
 Charles M. Means, Cons. Engr., Charles M. Means Co., 447 Oliver Bldg., Pittsburgh, Pa.

T. A. Parker, 411 Olive St., St. Louis, Mo.  
 Chas. H. Partington, Chief Engr., Cincinnati Frog & Switch Co., Cincinnati, Ohio.  
 H. K. Porter, Asst. to Gen. Sales Mgr., Hyatt Roller Bearing Co., Newark, N. J.  
 G. H. Shapler, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.  
 E. A. Watters, Genl. Supt., Hick Coal Companies, Box 405, Leechburg, Pa.  
 C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.

## SUB-COMMITTEE NO. 1—COAL MINE CAR DESIGN AND CONSTRUCTION

C. L. Herbster, Vice-Pres., Hockensmith Wheel & Mine Car Co., Penn, Pa.  
 W. C. Sanders, Gen. Mgr., Rwy. Div., Timken Roller Bearing Co., Canton, Ohio.  
 C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.  
 Victor Willoughby, Genl. Mech. Engr., Amer. Car & Foundry Co., 30 Church St., New York City.  
 C. K. Witmer, Master Mechanic, Westmoreland Coal Co., Irwin, Pa.

## SECTIONAL COMMITTEE ON TYPES OF HAND BRAKES

R. H. Kudlich (Chairman), U. S. Bureau of Mines, Washington, D. C.  
 Thos. G. Fear, Gen. Mgr., Operations, Consolidation Coal Co., Fairmont, W. Va.  
 Wm. J. Hill, Senior Engr., Travelers Insurance Co., Chamber of Commerce Bldg., Pittsburgh, Pa.  
 W. H. Robinson, Chf. Inspector, The Associated Companies, 207 Fulton Bldg., Pittsburgh, Pa.

## SECTIONAL COMMITTEE ON MINE CAR WHEELS

C. K. Witmer (Chairman), Master Mechanic, Westmoreland Coal Co., Irwin, Pa.  
 W. E. Farrell, Pres., Easton Car and Construction Co., Easton, Pa.  
 John M. Lewis, Chf. Engr., Houston Coal and Coke Co., 1532 Union Trust Bldg., Cincinnati, Ohio.  
 Cecil W. Smith, care Minnesota Northern Power Co., 831 Second Ave., South Minneapolis, Minn.  
 W. G. Srodes, Supt., Coal and Coke Dept., Shengano Furnace Co., Ligonier, Pa.

## SUB-COMMITTEE NO. 2—MINE TRACKS AND SIGNALS

Chas. H. Partington (Chairman), Chief Engineer, Cincinnati Frog & Switch Co., Cincinnati, Ohio.  
 C. A. Alden, Chf. Engr., Frog & Switch Dept., Bethlehem Steel Co., Steelton, Pa.  
 Geo. Ashton, Pres., The Central Frog & Switch Co., Cincinnati, Ohio.  
 Geo. M. Crawford, Crawford Machinery Co., Bessemer Bldg., Pittsburgh, Pa.  
 A. A. Culp, Consulting Engineer, 26 So. 20th St., Birmingham, Ala.  
 T. H. Edelblute, Representative of the Cincinnati Frog & Switch Co., Wabash Bldg., Pittsburgh, Pa.  
 Wm. F. Henke Asst. Engr., the Cincinnati Frog & Switch Co., Cincinnati, Ohio.  
 F. C. Hohn, Consulting Engineer, Pine Hill Coal Co., Minersville, Pa.  
 Wm. G. Hubert, Genl. Supt., Wm. Wharton, Jr., Company, Easton, Pa.  
 R. L. Ireland, Jr., M. A. Hanna Co., Cleveland, Ohio.  
 H. L. Koch, D. S. Mgr., Sweet's Steel Co., 2 Rector St., New York City.  
 Fred Norman, Chief Engineer, Allegheny River Mining Co., Kittanning, Pa.  
 W. Perdue, Chief Engineer, Chicago Works, Ramapo-Ajax Corporation, Chicago, Ill.  
 S. F. Perry, Central Frog & Switch Co., Diamond Bank Bldg., Pittsburgh, Pa.  
 J. B. Strong, President, Ramapo-Ajax Corporation, 30 Church St., New York City.  
 J. R. Ulrich, Bethlehem Steel Co., Bethlehem, Pa.  
 H. N. West, Mgr. Engr. and Works, Weir-Kilby Corporation, Norwood, Ohio.

## SUB-COMMITTEE NO. 3—MINE LOCOMOTIVES

Graham Bright (Chairman), Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.  
 Joe. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.  
 Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.  
 T. F. Downing, Jr., Cons. Engr., 5320 Walnut St., Philadelphia, Pa.  
 A. H. Egle, V. P., Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.  
 S. W. Farnham, Mng. Engr., Goodman Mfg. Co., 4834 S. Halsted St., Chicago, Ill.  
 W. J. Fene, Bureau of Mines, University of Utah, Salt Lake City, Utah.  
 G. H. Shapler, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.

## NATIONAL COMMITTEE ON MECHANIZED MINING

## NATIONAL CHAIRMAN

L. E. Young, V. P., Pittsburgh Coal Co., Pittsburgh, Pa.

## MECHANIZATION ENGINEER

G. R. Southward, 841 Munsey Bldg., Washington, D. C.

## GENERAL CHAIRMEN

Newell G. Alford, Consulting Engineer (Conveyors), 1302 Union Trust Bldg., Pittsburgh, Pa. W. D. Brennan, Gen. Mgr. (Management), Phelps Dodge Corp., Stag Canon Br., Dawson, N. Mex. A. C. Callen (Yearbook), School of Mines, University of Illinois, Urbana, Ill.

George Campbell, Asst. to Pres. (Cutting and Shearing), Old Ben Coal Corp., 230 S. Clark St., Chicago, Ill. Thomas Dawson, V. P. (Safety), H. C. Frick Coke Co., Scottsdale, Pa. Cadwallader Evans, Gen. Mgr. (Scrapers), Hudson Coal Co., Scranton, Pa.

R. L. Ireland, Gen. Mgr. (Transportation), M. A. Hanna Bituminous Coal Mines, Cleveland, Ohio. E. E. Jones, Mgr. (Drilling and Blasting), Lillybrook Coal Co., Lillybrook, Pa.

Dr. J. J. Rutledge (Ventilation), Maryland State Bureau of Mines, 22 Light St., Baltimore, Md. H. D. Smith, Asst. to Pres. (Coal Cleaning), Ashland Coal & Coke Co., Bluefield, W. Va.

R. M. Watt, District Mgr. (Power), Kentucky Utilities Co., Pineville, Ky.

Paul Weir, V. P. (Mechanical Loaders), Bell & Zoller Coal & Mng. Co., 307 N. Mich. Ave., Chicago, Ill.

R. Y. Williams, Consulting Engineer (Roof Action), Pottsville, Pa.

## STATE COMMITTEES

## Alabama

D. A. Thomas (Chairman), Pres. & Tr., Montevalle Coal Mng. Co., Birmingham, Ala.

Morris W. Bush, Alabama By-Products Corp., Birmingham, Ala.

G. F. DeBardeleben, Pres., Markeeta Coal Co., Birmingham, Ala.

M. H. Fies, V. P., DeBardeleben Coal Co., Birmingham, Ala.

J. A. Long, Woodward Iron Co., Woodward, Ala.

Geo. F. Peter, Southern Coal & Coke Co., Boothton, Ala.

## Colorado and New Mexico

D. A. Stout (Chairman), Chf. Engr. of Mines, Colorado Fuel & Iron Co., Pueblo, Colo.

H. H. Hubb, Gen. Supt., American Smelting & Refining Co., Cokedale, Colo.

Robt. McAlister, Chf. Mine Insp., Colorado Fuel & Iron Co., Trinidad, Colo.

H. D. Moses, Mgr., Gallup American Coal Co., Gamarco, N. Mex.

R. M. Perry, Gen. Supt., Moffat Coal Co., Denver, Colo.

Sam Tschir, Gen. Supt., National Fuel Co., Colorado Bldg., Denver, Colo.

F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Denver, Colo.

Robert Williams, Jr., Calumet Fuel Co., Somerset, Colo.

F. A. Young, Chf. Engr., St. Louis, Rocky Mountain & Pacific Co., Raton, N. Mex.

## Illinois

L. D. Smith (Chairman), V. P., Chicago, Wilmington & Franklin Coal Co., Chicago, Ill.

C. W. Clark, Supt., Standard Oil Co., Carlinville, Ill.

T. J. Thomas, Valier Coal Co., 547 W. Jackson Blvd., Chicago, Ill.

## Indiana and West Kentucky

David Ingles (Chairman), Pres., Ayrshire Coal Co., Oakfield City, Ind.

Carl Fletcher, Old Knox Mining Co., 1509 Merchants Bank Bldg., Indianapolis, Ind.

Lee Haskin's, J. K. Dering Coal Co., Clinton, Ind. J. R. Henderson, Francisco Coal Co., Box 22, Princeton, Ind.

T. C. Mullins, V. P. & G. M., Sunlight Coal Co., Booneville, Ind.

Wellington O'Connor, Ogle Coal Co., Indianapolis, Ind.

W. G. Duncan, Jr., Supt., W. G. Duncan Coal Co., Greenville, Ky.

## Kentucky, Virginia and Tennessee

R. E. Taggart (Chairman), V. P., Stonega Coke & Coal Co., Big Stone Gap, Va.

L. B. Abbott, Div. Engr., Consolidation Coal Co., Jenkins, Ky.

J. E. Butler, Gen. Mgr., Stearns Coal & Lumber Co., Stearns, Ky.

H. P. Finley, The Procter Coal Co., Jellico, Tenn.

Lee Long, Clinchfield Coal Corp., Dante, Va.

W. H. Peck, Gen. Mgr., Diamond Coal & Mng. Co., Coal Creek, Tenn.

Henry Pfenning, Jr., V. P., Blue Diamond Coal Co., Middlesborough, Ky.

L. C. Skeen, Fordson Coal Co., Stone, Ky.

## OFFICERS AND COMMITTEES, 1929 (Continued)

## Ohio

Ezra Van Horn (Chairman), Gen. Mgr., Clarkson Coal Mng. Co., Cleveland, Ohio.

E. J. Christy, Wheeling Township Coal Mng. Co., Adena, Ohio.

Wm. Emery, Jr., Pres., Cambridge Collieries Co., Cambridge, Ohio.

E. L. Thrower, Warner Collieries Co., 1708 Union Trust Bldg., Cleveland, Ohio.

## Pennsylvania—Anthracite

J. B. Warriner (Chairman), V. P., Lehigh Coal & Navigation Co., Lansford, Pa.

R. E. Hobart, Lehigh Coal & Navigation Co., Lansford, Pa.

E. P. Humphrey, Hazel Brook Coal Co., 1106 Marke Bk. Bldg., Hazleton, Pa.

W. H. Lesser, Madeira, Hill & Co., Frackville, Pa.

Jos. Mayers, Gen. Supt., Scranton Coal Co., Bd. of Trade Bldg., Scranton, Pa.

## Pennsylvania—Central

E. J. Newbaker (Chairman), Gen. Mgr., Berwind White Coal Mng. Co., Windber, Pa.

S. W. Blakley, Pennsylvania Coal & Coke Corp., Cresson, Pa.

F. B. Dunbar, Gen. Supt., Hillman Coal & Coke Co., 1st Natl. Bk. Bldg., Pittsburgh, Pa.

T. F. McCarthy, Clearfield Bituminous Coal Corp., Indiana, Pa.

## Pennsylvania—Western

W. L. Affelder (Chairman), Asst. to the Pres., Hillman Coal & Coke Co., Pittsburgh, Pa.

W. G. Fletcher, Gen. Supt., Inland Collieries Co., Indiana, Pa.

T. M. Gray, Asst. Supt., Pittsburgh Coal Co., Pittsburgh, Pa.

A. B. Kelley, Gen. Mgr., Humphreys Coal & Coke Co., Greensburg, Pa.

Fred Norman, Chf. Engr., Allegheny River Coal Mng. Co., Kittanning, Pa.

L. A. Weise, South Fayette Coal Co., Oliver Bldg., Pittsburgh, Pa.

## Texas, Oklahoma, and Arkansas

J. G. Putterbaugh (Chairman), Pres., McAlester Fuel Co., McAlester, Okla.

W. D. Putterbaugh, V. P. & Supt., Malakoff Fuel Co., McAlester, Okla.

T. J. Thompson, Arkansas Mining Co., Clarkville, Ark.

## Utah

D. D. Muir (Chairman), V. P., U. S. Smelting, Refining & Mng. Co., Salt Lake City, Utah.

I. N. Bayless, Gen. Supt., Utah Fuel Co., Castle Gate, Utah.

## West Virginia—Southern

M. L. Garvey (Chairman), Gen. Mgr., New River Co., Macdonald, W. Va.

Thos. Claggett, Chf. Engr., Pocahontas Coal Co., Bluefield, W. Va.

H. S. Gay, Jr., Gen. Supt., Gay Coal & Coke Co., Mt. Gay, W. Va.

P. C. Graney, Gen. Mgr., C. C. & B. Smokeless Coal Co., Mt. Hope, W. Va.

H. B. Husband, Chesapeake & Ohio Railway Co., Dorothy, W. Va.

J. S. McKeever, Kanawha & Hocking Coal & Coke Co., Longacre, W. Va.

J. M. Tulley, Gen. Supt., Crystal Block Coal & Coke Co., Sprig, W. Va.

Northern West Virginia and Maryland

F. R. Lyon (Chairman), V. P., Consolidation Coal Co., Fairmont, W. Va.

C. L. Chapman, W. Va. Coal & Coke Co., Box 1699, Huntington, W. Va.

Jas. H. Gibson, Gen. Engr., Wheeling Steel Corp., Wheeling, W. Va.

H. W. Showalter, Continental Coal Co., Fairmont, W. Va.

W. C. Shyder, Gen. Supt., Consolidation Coal Co., Frostburg, Md.

## Wyoming and Montana

Edward Bottomley (Chairman), Gen. Supt., Sheridan-Wyoming Coal Co., Kleenburn, Wyo.

F. V. Hicks, Union Pacific Coal Co., Rock Springs, Wyo.

R. E. Miller, Asst. Gen. Supt., Sheridan-Wyoming Coal Co., Kleenburn, Wyo.

Garner Reese, Kemmerer Coal Co., Kemmerer, Wyo.

## STANDARDIZATION DIVISION

## METAL MINING BRANCH

Lucien Eaton, Chairman

## Underground Power Transmission and Power Equipment

F. L. Stone, Chairman

F. L. Stone, Ind. Engr. Dept., General Electric Co., Schenectady, N. Y.

L. D. Anderson, Chf. Engr., U. S. Smelting, Refining and Mining Co., Salt Lake City, Utah, representing the National Safety Council.

John B. Andrews, Secy., American Association for Labor Legislation, 131 E. 23rd St., New York.

## F. L. Stone, Chairman

Alan C. Butterworth, Elec. Engr., Pickands, Mathes & Co., Seilwood Bldg., Duluth, Minn.

C. W. Corfield, Elec. Engr., Utah Copper Co., Garfield, Utah.

P. G. Dietrick, 5453 Nebraska Ave. N. W., Washington, D. C., representing the U. S. Department of Labor.

Carl Fichtel, Asst. Elec. Engr., Calumet & Hecla Copper Co., Calumet, Mich.

E. W. Fredell, Elec. Engr., United Verde Copper Co., Jerome, Ariz.

F. W. Gilbert, Elec. Engr., McIntyre Porcupine Mines, Ltd., Schumacher, Ont., Canada.

Arthur Halsted, Associate Elec. Engr., U. S. Bureau of Standards, Washington, D. C.

W. K. Liggett, Cons. Engr., Jeffrey Mfg. Co., Columbus, Ohio, representing the American Society of Mechanical Engineers.

G. E. Marble, Ind. Dept., General Electric Co., 230 S. Clark St., Chicago, Ill.

C. H. Matthews, Elec. Engr., Susquehanna Collieries Co., Miners Bk. Bldg., Wilkes-Barre, Pa.

Howard F. Pigg, Elec. Engr., Chateaugay Ore & Iron Co., Lyon Mountain, N. Y., representing the American Institute of Electrical Engineers.

Herbert Speight, Gen. Engr., Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

F. C. Stanford, Elec. Engr., Cleveland Cliffs Iron Co., Ishpeming, Mich., representing the Lake Superior Mining Institute.

A. N. Voss, Chf. Elec. Inspiration Cons. Copper Co., Inspiration, Ariz.

Arvid Wickstrom, Elec. Engr., M. A. Hanna & Co., 909 Fidelity Bldg., Duluth, Minn.

C. D. Woodward, Chf. Engr., Anaconda Copper Mng. Co., 508 Hennessy Bldg., Butte, Mont.

## Fire-Fighting Equipment

W. V. DeCamp, Chairman

W. Val DeCamp, Gen. Mine Supt., United Verde Copper Co., Box 436, Jerome, Ariz.

I. H. Barkdull, Gen. Mgr., Old Dominion Co., Globe, Ariz.

M. J. Bottinelli, Bunker Hill & Sullivan M. & C. Co., Kellogg, Idaho.

Jos. Cain, Supt., Gulf States Steel Co., Altoona, Ala.

H. M. Childs, Bunker Hill & Sullivan M. & C. Co., Kellogg, Idaho.

Wm. Conibear, Safety Insp., Cleveland-Cliffs Iron Co., Ishpeming, Mich.

Thos. Cowperthwaite, Safety Insp., Calumet & Arizona Mng. Co., Warren, Ariz.

H. C. Henrie, Mgr., Labor Dept., Phelps Dodge Corp., Bisbee, Ariz.

Guy J. Johnson, care Cerro de Pasco Copper Corp., Cerro de Pasco, S. A.

H. J. Rahilly, Asst. Gen. Supt., Anaconda Copper Mining Co., Original Stewart & Colorado Mines, Butte, Mont.

R. H. Seip, New Jersey Zinc Co., Franklin, N. J.

Chas. A. Smith, Asst. Gen. Mgr., Nevada Cons. Copper Co., Ray, Ariz.

A. C. Stoddard, Chf. Engr., Inspiration Cons. Copper Co., Inspiration, Ariz.

Albert Tallon, Safety Inspector, Old Dominion Co., Box 1694, Globe, Ariz.

W. N. Wampler, Safety Director, Eagle-Picher Lead Co., Joplin, Mo.

Orr Woodburn, Safety Engineer, Globe-Miami District, Globe, Ariz.

## Mechanical Loading Underground

Lucien Eaton, Chairman

## SUB-COMMITTEE NO. 1—LOADING MACHINES FOR TUNNELS, LARGE DRIFTS AND STOPES

Douglas C. Corner (Chairman), St. Louis Power Shovel Co., 320 Chemical Bldg., St. Louis, Mo.

J. H. Hensley, Mine Supt., Miami Copper Co., Miami, Ariz.

H. DeWitt Smith, United Verde Copper Co., 111 Broadway, New York City.

A. E. Southmayd, Mining Machinery Division, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

H. G. Washburn, Asst. Gen. Mgr., Federal Mining & Smelting Co., Wallace, Idaho.

William Whaley, Gen. Mgr., Myers-Whaley Co., Knoxville, Tenn.

## SUB-COMMITTEE NO. 2—LOADING MACHINES FOR SMALL DRIFTS AND FOR WORK ON SUB-LEVELS

G. R. Jackson (Chairman), Supt., Cleveland-Cliffs Iron Co., Neogaunee, Mich.

C. L. Berrien, Gen. Supt. of Mines, Anaconda Copper Mining Co., Box 1375, Butte, Mont.

H. H. Talboys, Mgr., Showalter Dept., Nordberg Mfg. Co., Milwaukee, Wis.

Chas. E. Van Barneveld, Chatsworth, Calif.

## SUB-COMMITTEE NO. 3—SCRAPERS

Lucien Eaton (Chairman), Supt., Ishpeming District, Cleveland-Cliffs Iron Co., Ishpeming, Mich.

C. L. Kohlhas, Denver Rock Drill Co., Duluth, Minn.

Ward Royce, Ingersoll-Rand Co., 526 1st Ave. So., Seattle, Wash.

E. E. Whiteley, Asst. Mgr., Calumet & Arizona Mng. Co., Box 705, Warren, Ariz.

## OFFICERS AND COMMITTEES, 1929 (Continued)

## Drilling Machines and Drill Steel

Chairman

## SUB-COMMITTEE NO. 1—STANDARDIZATION OF DRILLING MACHINES

B. F. Tilson (Chairman), Asst. Supt., New Jersey Zinc Co., Franklin, N. J.  
 L. C. Bayles, Designing Engr., Rock Drill Dept., Ingersoll-Rand Co., Phillipsburg, N. J.  
 Arthur B. Foote, Gen. Mgr., North Star Mines Co., Grass Valley, Calif.  
 J. A. Fulton, Idaho-Maryland Mines Co., Grass Valley, Calif.  
 Roy H. Marks, Efficiency Engr., United Verde Extension Mining Co., Box 195, Jerome, Ariz.  
 R. T. Murrill, Efficiency Engr., St. Joseph Lead Co., Rivermeine, Mo.  
 W. G. Scott, Supt., Morenci Branch, Phelps Dodge Corp., Morenci, Ariz.  
 George A. Shaw, Mine Supt., Talache Mines, Inc., Quartzburg, Idaho.  
 H. T. Walsh, V. P., Sullivan Machinery Co., Peoples Gas Bldg., Chicago, Ill.

## SUB-COMMITTEE NO. 2—STANDARDIZATION OF DRILL STEEL

Frank Ayer, Mgr., Morenci Branch, Phelps Dodge Corp., Morenci, Ariz.  
 O. J. Egleson, Fairbanks, Alaska.  
 C. S. Elsley, Clouderon, N. Mex.  
 E. F. Hastings, Salesman, Ingersoll-Rand Co. of Texas, P. O. Box 1834, Globe, Ariz.  
 Chas. S. Hurter, Technical Representative, E. I. du Pont de Nemours & Co., Inc., 5104 Du Pont Bldg., Wilmington, Del.  
 Chas. B. Officer, Chf. Engr., Sullivan Machinery Co., 122 So. Michigan Ave., Chicago, Ill.  
 Henry S. Potter, Managing Director, Henry S. Potter, Ltd., 22 Cullinan Bldg., Johannesburg, S. A.  
 Ocha Potter, Supt., Ahmeek-Kearnsarge Br., Calumet & Hecla Mng. Co., Ahmeek, Mich.  
 Chas. A. Smith, Asst. Gen. Mgr., Ray Consolidated Copper Co., Ray, Ariz.  
 A. S. Uhler, Mgr., Rock Drill Sales, Ingersoll-Rand Co., 11 Broadway, New York, N. Y.  
 M. van Sien, Cosmos Club, Washington, D. C.  
 Bruce C. Yates, Gen. Mgr., Homestake Mining Co., Lead, S. Dak.

## SUB-COMMITTEE NO. 3—STANDARDIZED METHODS OF SHARPENING DRILL STEEL

George H. Gilman, Pres., Gilman Mfg. Co., E. Boston, Mass.  
 Frank W. McLean, Supt., San Francisco Mines of Mexico, Ltd., San Francisco del Oro, Chihuahua, Mexico.  
 W. H. Schacht, Gen. Mgr., Copper Range Co., Painesdale, Mich.  
 H. W. Seaman, Mgr., Aukerite Mines, Box 535, So. Porcupine, Ontario.

## Mine Timbering

Dr. Frank H. Probert, Chairman

## SUB-COMMITTEE NO. 1—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (Chairman), In Charge, Section of Wood Preservation, Forest Products Laboratory, Madison, Wis.  
 Dr. H. C. Gardiner, care Anaconda Copper Mng. Co., Anaconda, Mont.  
 J. H. Hensley, Miami Copper Co., Miami, Ariz.  
 J. L. Hyde, Mine Timber Dept., Cleveland-Cliffs Iron Co., Ishpeming, Mich.  
 C. N. Kerr, American Wood Preservatives Association, 10 So. LaSalle St., Chicago, Ill.  
 Gerald Sherman, Consulting Mining Engineer, Phelps Dodge Corp., P. O. Box 1158, Douglas, Ariz.  
 H. E. Tuff, Grasselli Chemical Co., Cleveland, Ohio.

## SUB-COMMITTEE NO. 2—GUNITE AS A SUBSTITUTE FOR TIMBER, ITS PROPER APPLICATION AND ITS LIMITATIONS

E. M. Norris (Chairman), Supt., Fertilizer Dept., Anaconda Copper Mining Co., Conda, Idaho.  
 B. C. Collier, Pres., Cement-Gun Co., Inc., 8 10th and Mill Sts., Allentown, Pa.  
 R. R. Hornor Consulting Engr., 142 E. Main St., Clarksburg, W. Va.

## SUB-COMMITTEE NO. 3—DETERMINATION OF SIZE AND SHAPE OF DRIFT AND DRIFT TIMBERS FOR VARIOUS PURPOSES, WITH A VIEW TO REDUCING SAME TO CERTAIN STANDARD SIZES AND SHAPES

Prof. F. W. Sperr (Chairman), Prof. of Civil and Mining Engineering, Michigan College of Mines, 315 Florence St., Houghton, Mich.  
 C. L. Berrien, Gen. Supt. of Mines, Anaconda Copper Mining Co., Box 1375, Butte, Mont.  
 Feltie P. McDonald, Mine Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.

## SUB-COMMITTEE NO. 4—COOPERATION BETWEEN OPERATORS AND LUMBER DEALERS AND MANUFACTURERS, WITH A VIEW TO ASCERTAINING WHETHER STANDARDIZATION IN SIZES AND SHAPES OF LUMBER UNDERGROUND WOULD RESULT IN A REDUCTION IN COST TO MINING COMPANIES

Chas. F. Willis (Chairman), Editor and Publisher, The Mining Journal, Homebuilders Bldg., Phoenix, Ariz.

W. S. Boyd, Asst. Mgr. Director, Nevada Cons. Copper Co., 1800 Hobart Bldg., San Francisco.  
 T. Evans, Gen. Mgr., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.  
 D. F. Holtman, Asst. Director, National Committee on Wood Utilization, Department of Commerce, Washington, D. C.  
 G. R. Jackson, Supt., Negauane Mine, Cleveland-Cliffs Iron Co., Negauane, Mich.  
 G. M. McBride, Gen. Mgr., Old Dominion Co., Globe, Ariz.

## Mine Ventilation

Chairman

N. L. Alison, American Blower Co., Denver, Colo.  
 Robt. N. Bell, Cons. Mng. Engr., Boise, Idaho.  
 Walter C. Browning, Cons. Engr., 1218 Pacific Mutual Bldg., Los Angeles, Calif.  
 O. E. Dyer, Mgr., Small Blower Dept., Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.  
 A. B. Foote, Gen. Mgr., North Star Mines Co., Grass Valley, Calif.  
 D. Harrington, U. S. Bureau of Mines, Washington, D. C.  
 W. S. Larsh, Gen. Supt., Nevada Cons. Copper Co., Ruth, Nev.  
 E. T. Lendum, Mgr., E. I. du Pont de Nemours & Co., Inc., 406 Ideal Bldg., Denver, Colo.  
 Charles Legrand, Cons. Engr., Phelps Dodge Corp., Douglas, Ariz.  
 F. W. Maciennan, Gen. Mgr., Miami Copper Co., Miami, Ariz.  
 W. J. Montgomery, Mine Fan Dept., Jeffrey Mfg. Co., Columbus, Ohio.  
 Don M. Rait, Supt. of Mines, Calumet & Arizona Mng. Co., Warren, Ariz.  
 A. S. Richardson, Ventilation Engr., Anaconda Copper Mng. Co., Butte, Mont.  
 Geo. H. Rupp, Calumet and Hecla Cons. Copper Co., Calumet, Mich.  
 A. C. Stoddard, Chf. Mine Engr., Inspiration Cons. Copper Co., Box 15, Inspiration, Ariz.  
 F. L. Stone, Ind. Engr. Dept., General Electric Co., Schenectady, N. Y.  
 Walter S. Weeks, Professor of Mining, University of California, Berkeley, Calif.  
 F. B. Williams, Mgr., Mining Dept., B. F. Sturtevant Co., Hyde Park, Boston, Mass.

## Mine Drainage

Chairman

H. T. Abrams, Dept. Mgr. of Air Life Pumps and "Calyx" Drills, Ingersoll-Rand Company, 11 Broadway, New York City.  
 Wm. H. Gallagher, Jr., Chief Engineer, Pickands, Mather & Co., Duluth, Minn.  
 G. L. Kollberg, Mgr., Pumping Engine Dept., Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 G. D. McClure, Chief Mechanical Engr., Cleveland-Cliffs Iron Co., Ishpeming, Mich.  
 Charles Mendelsohn, Mech. Supt., Old Dominion Co., Globe, Ariz.  
 M. G. Meyers, Elec. Engr., Copper Range Co., Painesdale, Mich.  
 C. D. Woodward, Chf. Engr., Anaconda Copper Mng. Co., 508 Hennessy Bldg., Butte, Mont.

Mining Excavating Equipment  
Exclusive of "Dredges"

H. D. Goodrich, Chairman

H. D. Goodrich, Chf. Engr., Utah Copper Co., Kearns Bldg., Salt Lake City, Utah.  
 H. G. S. Anderson, Mining and Metallurgical Engineer, Rolla, Mo.  
 H. C. Bellinger, V. P., Chile Exploration Co., 25 Broadway, New York City.  
 M. J. Curley, Mgr., New Cornelia Copper Co., Ajo, Ariz.  
 Grant Davis, Adv. Mgr., The Marion Steam Shovel Co., Marion, Ohio.  
 C. B. Lakenan, Gen. Mgr., Nevada Cons. Copper Co., McGill, Nev.  
 C. H. Matthews, Elec. Engr., Susquehanna Collieries Co., Miners Bank Bldg., Wilkes-Barre, Pa.  
 Geo. Meyer, Supt., United Verde Copper Co., Clarkdale, Ariz.  
 G. A. Murfey, Pres. and Chf. Engr., The Brown-Ing-Crane Co., 16226 Waterloo Rd., Cleveland.  
 Henry H. Oatley, V. P., The Superheater Co., 17 East 42nd St., New York City.  
 Thomas A. Snyder, Bucyrus, Erie Co., So. Milwaukee, Wis.  
 Robert E. Tally, Gen. Mgr., United Verde Copper Co., Clarkdale, Ariz.  
 J. C. Wheat, Dev. Engr., Industrial Works, Bay City, Mich.  
 Chas. A. Whitaker, V. P., Winston Brothers Co., 801 Globe Bldg., Minneapolis, Minn.

## Underground Transportation

Chairman

Thos. C. Baker, Gen. Mgr., The Mexican Corporation, S. A., Fresnillo Unit, Fresnillo, Zacatecas, Mexico.  
 Geo. N. Booth, Mech. Engr., Inspiration Cons. Copper Co., Box 219, Inspiration, Ariz.  
 R. R. Boyd, 616 Foothill Rd., Beverly Hills, Calif.  
 D. S. Calland, Managing Director, Box 32, Point Loma, Calif.

W. R. Crane, U. S. Bureau of Mines, Houghton, Mich.

W. Val DeCamp, Gen. Mine Supt., United Verde Copper Co., Box 436, Jerome, Ariz.  
 Robert H. Dickson, Mgr., Verde Central Mines, Inc., Jerome, Ariz.

Stanly A. Easton, V. P. and Mgr., Bunker Hill & Sullivan M. & C. Co., Kellogg, Idaho.

H. T. Hamilton, Cons. Mng. Engr., 1402 California Commercial Union Bldg., San Francisco, Calif.

F. H. Hayes, Mine Supt., Copper Queen Branch, Phelps Dodge Corp., Bisbee, Ariz.

R. E. Howe, Gen. Supt., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.

C. A. Lantz, Gen. Mgr., Compania de Santa Gertrudis, S. A., Apartado No. 1, Pachuca, Hidalgo, Mexico.

E. M. Norris, Supt., Fertilizer Dept., Anaconda Copper Mng. Co., Conda, Idaho.

T. A. Scott, Supt., Munro Iron Mng. Co., Iron River, Mich.

## Mine Accounting

T. O. McGrath, Chairman

T. O. McGrath, Mgr., Shattuck-Denn Mng. Corp., Bisbee, Ariz.

Edgar R. Alpaugh, Secy.-Treas., Vanadium Corporation of America, 120 Broadway, New York City.

L. S. Gates, V. P. and G. M., Utah Copper Co., Salt Lake City, Utah.

J. C. Dick, Mng. Engr., 1501 Walker Bank Bldg., Salt Lake City, Utah.

H. B. Fernald, Loomis, Safford & Fernald, 50 Broad St., New York City.

H. H. Miller, Gen. Auditor, Hercules Mining Co., Wallace, Idaho.

H. L. Norton, 26 Pearl St., Medford, Mass.

Harry Vivian, Chf. Engr., Calumet & Hecla Cons. Copper Co., Calumet, Mich.

## Milling and Smelting Practices and Equipment

Arthur Crowfoot, Chairman

## SUB-COMMITTEE NO. 1—MILLING PRACTICES AND EQUIPMENT

Arthur Crowfoot (Chairman), Mill Supt., Phelps Dodge Corp., Morenci, Ariz.

H. G. S. Anderson, Rolla, Mo.

Herman C. Bellinger, V. P., Chile Exploration Co., 25 Broadway, New York City.

Allan J. Clark, Superintendent of Mills, Home-stake Mining Co., Lead, S. Dak.

G. R. Delamater, Fuel Engr., W. S. Tyler Co., Cleveland, Ohio.

W. M. Drury, 1112 Mills Bldg., El Paso, Tex.

Prof. Carle R. Hayward, Assoc. Prof. of Metallurgy, Mass. Institute of Technology, 69 Massachusetts Ave., Cambridge, Mass.

Guy H. Ruggles, Mill Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.

Henry A. Tobelmann, Asst. Pres., Ohio Copper Co. of Utah, 506 Clift Bldg., Salt Lake City, Utah.

William Young Westervelt, Consulting Mining Engineer, 522 Fifth Ave., New York City.

## SUB-COMMITTEE NO. 2—SMELTING PRACTICES AND EQUIPMENT

J. Owen Ambler, Smelter Supt., Phelps Dodge Corp., Copper Queen Branch, Clifton, Ariz.

P. F. Butler, 116 East 2nd St., Tucson, Ariz.

Harry A. Clark, Mgr., Calumet & Arizona Mng. Co., Warren, Ariz.

Geo. W. Prince, Asst. Gen. Mgr., United Verde Extension Mng. Co., Clemenceau, Ariz.

Forest Rutherford, Consulting Metallurgical Engr., 50 Broad St., New York City.

## Methods of Mine Sampling, Methods of Recording Underground Geological Data, and Methods of Estimation of Ore Reserves for Low, Medium and High-Grade Ore Bodies

Philip D. Wilson, Chairman

Philip D. Wilson, American Metal Co., Ltd., 61 Broadway, New York City.

Guy N. Bjorge, 411 Balfour Bldg., San Francisco, Calif.

E. L. Derby, Jr., Chief Geologist, Cleveland-Cliffs Iron Co., 200 Euclid St., Ishpeming, Mich.

M. J. Elsing, Mining Engineer and Geologist, Warren, Ariz.

Prof. L. C. Graton, Professor of Geology, Ratch Bldg., Harvard University, Cambridge, Mass.

Julius Krutschmidt, Jr., Mgr., Mining Dept. of the Southwest, American Smelting & Refining Co., P. O. Box 1616, Tucson, Ariz.

F. A. Linforth, Asst. Chf. Geol. & Asst. Chf. Mng. Engr., Anaconda Copper Mining Co., Butte, Mont.

Albert Mendelsohn, Gen. Mine Supt., Copper Range Co., Painesdale, Mich.

McHenry Mosier, Mine Supt., Morenci Branch, Phelps Dodge Corp., Morenci, Ariz.

Louis E. Reber, Jr., Chief Geologist, United Verde Copper Co., Jerome, Ariz.

T. Skeens Saunders, Cons. Mining Engineer, Av. Cineo de Mayo 10, Despacho 33, Mexico, D. F.

J. R. Tenney, Arizona Bureau of Mines, 630 N. Park Ave., Tucson, Ariz.

Ro. W. Thomas, Supt. of Mines, Ray Consolidated Copper Co., Ray, Ariz.

# INDEX TO ADVERTISERS

Page	Page		
Allis-Chalmers Mfg. Co. ....	29	La Bour Co. ....	27
American Cable Co. ....	21	Lehigh Coal & Navigation Co. ....	11
American Coal Cleaning Corp. ....	Inside Back Cover	Mining Safety Device Co. ....	31
American Steel & Wire Co. ....	31	Morse Chain Co. ....	Back Cover
Ayer & Lord Tie Co. ....	37	National Carbon Co. ....	19
Byers Co., A. M. ....	23	Ohio Brass Co. ....	10
Byrne & Lane. ....	33	Oxweld Acetylene Co. ....	22
Card Iron Works Co., C. S. ....	37	Patrick, R. S. ....	35
Carnegie Steel Co. ....	16	Pennsylvania Drilling Co. ....	39
Central Frog & Switch Co., The. ....	33	Phelps Dodge Corp. ....	37
Connellsville Mfg. & Mine Supply Co. ....	35	Phillips Mine & Mill Supply Co. ....	33
Conveyor Sales Co., Inc. ....	14	Roberts & Schaefer Co. ....	3
Curtin-Howe Corp. ....	20	Robinson Ventilating Co. ....	35
Diamond Drill Carbon Co., The. ....	37	Roebling's Sons Co., John A. ....	5
Ellis Mills Mfg. Co. ....	35	Standard Oil Co. (Ind.) ....	17
Enterprise Wheel & Car Corp. ....	31	Stonehouse Signs, Inc. ....	39
General Electric Company. ....	18	Sullivan Machinery Co. ....	37
Goodman Mfg. Co. ....	15	Thorne Neale & Co., Inc. ....	39
Hercules Powder Co. ....	24	Timken Roller Bearing Co. ....	26
Hoffman Bros. ....	39	Tyler Co., The W. S. ....	9
Hyatt Roller Bearing Co. ....	12	Union Carbide & Carbon Corp. ....	25
Irvington Smelt. & Ref. Works. ....	37	Vulcan Iron Works. ....	29
Jeffrey Mfg. Co. ....	6-7	Webster Mfg. Co., The. ....	35
Johnson Wrecking Frog Co., The. ....	37	Westinghouse Elec. & Mfg. Co. ....	8
Joy Mfg. Co. ....	13	West Virginia Rail Co. ....	33
Keystone Lubricating Co. ....	46	Willmarth, O. Barlow. ....	39

THE KEYSTONE LUBRICATING CO.  
Executive Office and Works: Philadelphia, Pa.

## Position Wanted

Competent Mining Engineer and Operating Executive with 25 years experience in coal mining industry.

Technical graduate with exceptional experience in engineering and operating problems.

Available immediately—first class references furnished.  
Address M. C. J. 121.

## Who Among Your Immediate Friends

Should receive The Mining Congress Journal? You find it helpful—so would they. Tell them of its value to you.

# PNEUMATIC COAL SEPARATION RECORD

1920-1925

ANNUAL SEPARATING CAPACITY INSTALLED	1,776,000 Tons
St. Louis, Rocky Mountain & Pacific Coal Co., Brilliant, N. Mex.	West Canadian Collieries Ltd., Blairmore, Alberta, Canada.
McAllester-Edwards Coal Company, Pittsburgh, Okla.	National Carbon Company, Niagara Falls, N. Y.
American Coal Company of Allegany County, McComas, W. Va.	Sumet Solvay Coke Company, Detroit, Michigan.
Gulf Smokeless Coal Company, Wyco, W. Va.	Premier Red Ash Coal Corporation, Red Ash, Virginia.
	Heworth Coal Company, Ltd., Heworth, County Durham, England.

1926

ANNUAL SEPARATING CAPACITY INSTALLED	2,784,000 Tons
International Coal & Coke Co., Ltd., Coleman, Alberta, Canada.	MacAlpin Coal & Coke Company, MacAlpin, W. Va.
McGillivray Creek Coal & Coke Co., Coleman, Alberta, Canada.	Superior Pocahontas Coal Company, Davy, W. Va.
John Bowes & Partners, Ltd., Wardley, County Durham, England.	New River & Pocahontas Consolidated Coal Co., Newhall, W. Va.
* American Coal Company of Allegany County, McComas, W. Va.	Altham Collieries, Ltd., Accrington, Lancashire, England.
Turkey Gap Coal & Coke Co., Modoc Colliery, Wenonah, W. Va.	* Premier Red Ash Coal Corporation, Red Ash, Virginia.

1927

ANNUAL SEPARATING CAPACITY SOLD AND INSTALLED	3,544,000 Tons
Pease & Partners, Ltd., Thorne Colliery, Near Doncaster, Yorkshire, England.	* New River & Pocahontas Consolidated Coal Co., Newhall, W. Va.
Horden Collieries, Ltd., Horden Colliery, County Durham, England.	Crystal Block Coal & Coke Company, Stirratt, W. Va.
* West Canadian Collieries, Ltd., Bellevue, Alberta, Canada.	Central Pocahontas Coal Company, Anawalt, W. Va.
Hebburn Collieries, Ltd., Newcastle, Australia.	Arlington Coal & Coke Company, McDowell, W. Va.
* New River & Pocahontas Consolidated Coal Co., Berwind, W. Va.	Gilliam Coal & Coke Company, Gilliam, W. Va.
	Kingston Coal Company, Kingston, Pa.

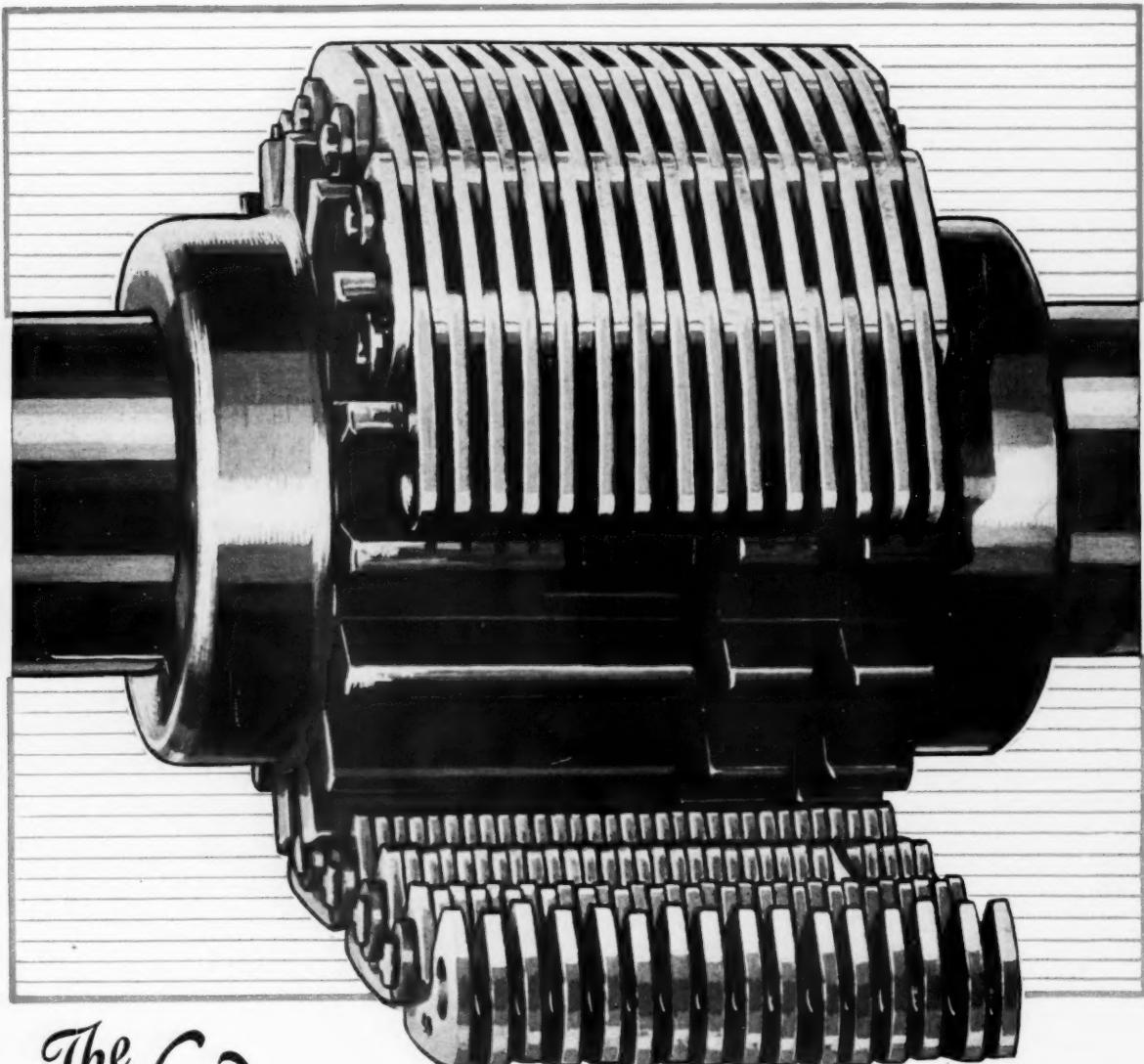
1928

ANNUAL SEPARATING CAPACITY SOLD AND INSTALLED	6,896,000 Tons
Chafin, Jones, Heatherman Coal Co., Peach Creek, W. Va.	* New River & Pocahontas Consolidated Coal Co., Berwind, W. Va.
Cleveland Cliffs Iron Company, Ethel, W. Va.	* New River & Pocahontas Consolidated Coal Co., Newhall, W. Va.
Crystal Block Mining Company, Lobjato, W. Va.	* Pearson & Dorman Long, Ltd., Snowdown, Kent, England.
Humphreys Coal & Coke Company, Greensburg, Pa.	Consett Iron Company, Consett, County Durham, England.
* Humphreys Coal & Coke Company, Greensburg, Pa.	Ashington Coal Company, Ltd., Ashington, Northumberland, England.
Central Alabama Coal Company, Kimberly, Alabama.	* John Bowes & Partners, Ltd., Wardley, County Durham, England.
Union Carbide Company, Niagara Falls, N. Y.	Pelaw Main Collieries Company, Birtley, County Durham, England.
Morrison Coal Company, Glen Morrison, W. Va.	Charlaw & Sacriston Collieries, Ltd., England.
* MacAlpin Coal & Coke Company, MacAlpin, W. Va.	Londonderry Collieries, Ltd., Seaham Colliery, England.
	Lambton, Hetton & Joicey Colliery, Ltd., England.
	Zaklad Hohenlohego Hohenlohego-Werke, Spolka Akeyjna, Welnowiec, C. S. I., Poland.
	Messrs. Schuchtermann & Kremer-Baum, Dahlbusch, Germany.
	Bedlington Coal Company, Ltd., England.

—\* Denotes repeat orders.

TOTAL ANNUAL SEPARATION AND  
CLEANING CAPACITY TO DATE  
15,000,000 Tons

AMERICAN  
(Sutton, Steele & Steele Patents)  
COAL CLEANING CORPORATION  
WELCH, W. VA.  
Designers and Erectors of Pneumatic  
Coal Cleaning Plants



## *The New* MORSE Flexible Coupling

Morse  
Chain Co.  
Ithaca, N. Y.

Please send complete data on the new Morse Flexible Coupling to:

Name.....  
Position.....  
Company.....  
Address.....  
City and State.....

MCJ

Simplicity is the keynote in the design of this new Morse Flexible Coupling. It consists merely of a Morse Silent Chain encircling two sprockets as shown. The guide groove in one sprocket holds chain in place while the other sprocket is free to float under the chain. The chain fits loosely enough on the sprocket to take care of ordinary misalignment.

Simple design combined with the high efficiency and long life for which Morse Chains are noted, provides a coupling ideal for most requirements. Fill in the coupon for complete data.

**MORSE CHAIN CO., ITHACA, N. Y.**

*Branches in Principal Cities*

Manufacturers of the Original Morse Rocker Joint Chain,  
the most widely used silent chain in the world

® 3003

